PROPOSED GEOTHERMAL LEASING VALE ADDITION

ENVIRONMENTAL ANALYSIS RECORD

VALE DISTRICT, OREGON

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

43 CFR PART 23

TECHNICAL EXAMINATION REPORT

AND

ENVIRONMENTAL

ANALYSIS RECORD

FOR

VALE KNOWN

GEOTHERMAL

RESOURCE

AREA

ADDITION

AND

ADJACENT

LANDS

July 1975

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Section 31. Special Stipulations:

The Lessee shall comply with the following additional special conditions and stipulations, unless they are modified by mutual agreement of the Lessee, Supervisor, and Authorized Officer.

(a) The Lessee will not occupy or disturb the area within 600 feet each side of the Oregon Trail as delineated on Illustration 14 .

(b) The Lessee will not occupy or disturb the surface of the following sites:

(1) Vale City Dump NW¼SE¼ Sec. 32, T. 18 S., R. 45 E. W.M.
(2) Lytle Dump NE¼SW¼ Sec. 31, T. 19 S., R. 46 E. W.M.
SE¼SW¼ Sec. 31, T. 19 S., R. 46 E. W.M.
SW¼SE¼ Sec. 31, T. 19 S., R. 46 E. W.M.
NE¼NE¼ Sec. 6, T. 20 S., R. 46 E. W.M.

(3) Highway Material Site OR 05020
N½N½NW¼NE¼ Sec. 23, T. 19 S., R. 45 E. W.M.
SW¼SE¼ Sec. 14, T. 19 S., R. 45 E. W.M.
SE¼SE¼ Sec. 14, T. 19 S., R. 45 E. W.M.
NW¼SW¼ Sec. 32, T. 19 S., R. 46 E. W.M.
SW¼SW¼ Sec. 32, T. 19 S., R. 46 E. W.M.

(4) Free Use Permit OR 016864
W½NE¼SE¼ Sec. 4, T. 18 S., R. 45 E. W.M.
NE¼SW¼NE¼ Sec. 4, T. 18 S., R. 45 E. W.M.

(c) The Lessee will dispose of waste material only in sites designated by the Authorized Officer.

(d) The Lessee shall contact the Authorized Officer prior to development of a plan of operation to be apprised of practices which should be followed or avoided in field development, including but not limited to such matters as road standards, road crossings, gates, cattleguards, fencing, erosion control, surface rehabilitation, stockwater reservoirs, stockwater wells and springs.

(e) "Prior to any operations under this lease, the Leasee will engage in a qualified archeologist, acceptable to the Authorized Officer, to make an archeological survey of the land to be disturbed or occupied. A certified statement, signed by the qualified archeologist, setting out the steps taken in the survey and the findings thereof as to the existence of antiquities or other objects of historic or scientific

interest, shall be submitted to the Authorized Officer. If the statement indicates the existence of such objects which might be disturbed by operations under this lease, the Leasee shall take such mitigating actions as may be required by the Authorized Officer, including archeological salvage, or protective measures, or avoidance of the site, to protect and preserve such objects."

ENVIRONMENTAL ANALYSIS RECORD FOR VALE KNOWN

GEOTHERMAL RESOURCE AREA ADDITION AND ADJACENT LANDS

PREFACE:

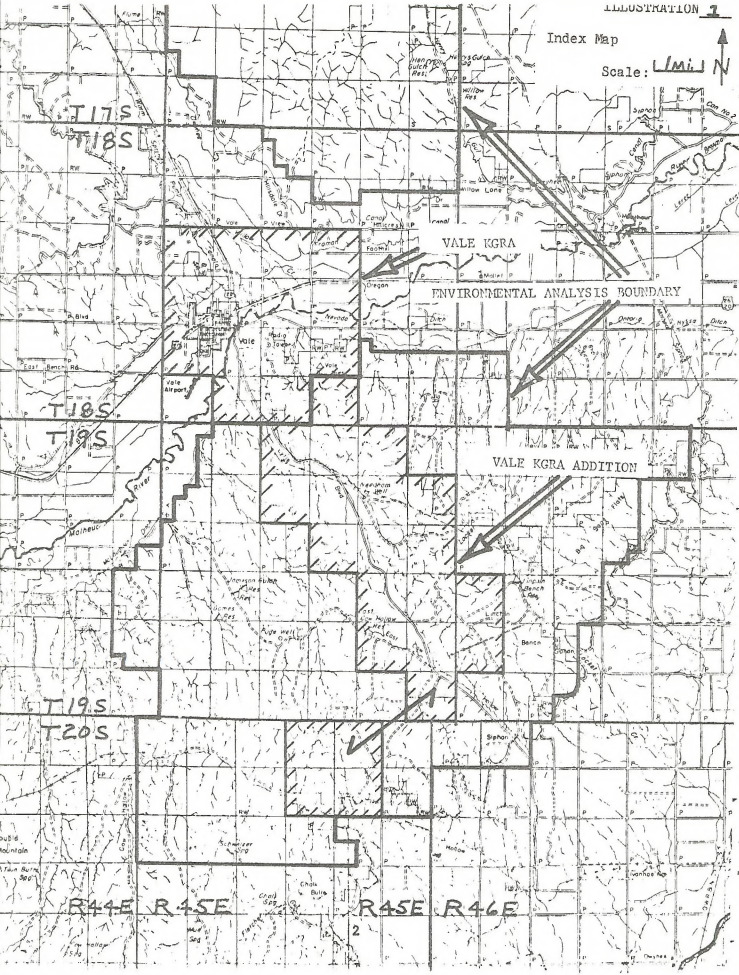
On June 27, 1974, Republic Geothermal, Inc., of Whittier, California bid $10.26 per acre to lease the 1347.17 acres of National Resource Lands within the Vale Known Geothermal Resource Area (KGRA). This was the highest of four bids received in the competitive sale to lease the area for geothermal exploration and development. There are 7593.15 acres of private land in the Vale KGRA (See Illustration 1). The federal land is located from one-half to two and one-half miles southeast of Vale. An isolated 80 acre parcel of federal land lies three-quarters of a mile north of Vale.

On August 2, 1974, Republic Geothermal, Inc., submitted a plan of operation as required by the Code of Federal Regulations, Title 43, Part 3210.2-1(d) to the State Director of the Bureau of Land Management in Portland, Oregon. The plan outlines three distinct phases as follows: (1) Initial geologic study - this involves surface geologic mapping with field crews using existing roads and trails. No surface disturbance is involved. (2) Self-potential study - involves gathering of geophysical data by field crews using existing roads and trails. No surface disturbance is involved. (3) Detailed heat flow study - involves drilling 5 holes to approximately 500 feet and installing a 1 inch diameter steel pipe containing a thermistor in order to monitor subsurface temperatures for a period of time. There is no time-table attached to this plan. As of December 24, 1974, no action has been taken by Republic Geothermal to implement the plan.

Magma Energy, Inc., of Los Angeles, California has a lease on private land adjacent to the Vale KGRA. They have been expected to commence a deep exploration test drill hole for several months, but as of this report they are not yet drilling in the Vale area. A drill pad with mud pits has been constructed and 27 feet of surface casing set in preparation for the big rig.

Several major energy companies have conducted geophysical exploration studies for geothermal resources in the Vale vicinity within the last six months. Additional geologic studies by the U. S. Geological Survey prompted them, on May 30, 1974, to add 11,535.27 acres as an addition to the Vale KGRA. Overlapping non-competitive geothermal lease applications prompted the BLM to add 2522.56 acres on December 18, 1974. The U. S. Geological Survey subsequently added these acres to their previous addition to the Vale KGRA. This total of 14,057.83 acres is collectively referred to as the Vale KGRA Addition. These lands lie within the line identified as Vale KGRA Addition on Illustration 1.

ILLUSTRATION 1



No non-competitive geothermal leases have been issued in the Vale District to date, but a large number of applications have been filed. Because many of the lease applications are for nearby lands that are similar in character to the Vale KGRA Addition, these acreages are being included in this Environmental Analysis Record. These lands lie within the line identified as the Environmental Analysis Boundary but outside the Vale KGRA Addition line on Illustration 1. See Illustration 7 for the precise location of these applications.

Within the Environmental Analysis Boundary, private acreages exist where the Federal Government owns the mineral estate. These acreages, identified on Illustration 6, are also covered by this Environmental Analysis Record.

In summary, the following Technical Report and Environmental Analysis Record is written to include all land belonging to the Federal Government within the EAR boundary line, and those private acres within the Environmental Analysis Boundary where the Federal Government owns the mineral estate. Acreage figures can be found on Illustration 2. For the legal description of all acreages refer to Illustrations 3, 4, and 5.

The non-competitive leases will be awarded to qualified applicants following the receipt and evaluation of the required operating plans. A number of the leases are expected to be issued in 1975.

I. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVE

The proposed action involves the leasing of Federally owned geothermal resources for exploration and development pursuant to the Geothermal Steam Act of 1970. The development of geothermal steam and associated resources involves the harnessing of the natural heat energy sources in the earth for the generation of electric power and the production of commercially valuable by-products.

The proposed action is to take place on 13,217.83 acres of U. S. Government land within the Vale KGRA Addition (Refer to Illustration 3 for legal description) and on 32,797.56 acres of U. S. Government land that lie near but outside the KGRA Addition (Refer to Illustration 4 for legal description). If geothermal resources are decided in the courts to be part of the mineral estate, the proposed action may take place on 4,242.16 acres of private land on which the Federal Government owns the mineral estate (Refer to Illustration 5 for legal description). For orientation to the location of the land, refer Illustration 6.

SURFACE ACREAGE TOTALS

Acres of vacant NRL in KGRA Addition	13,197.83
Acres of Reclamation Withdrawal in KGRA Addition	20.00
Total acres of government land in KGRA Addition	*13,217.83
Acres of private land in KGRA Addition	** 840.00
Total acres of private and government land in the KGRA Addition	***14,057.83
Acres of vacant NRL in EAR Area exclusive of KGRA Addition	32,187.40
Acres of Reclamation Withdrawal in EAR Area exclusive of KGRA Add.	610.16
Total government land in EAR Area exclusive of KGRA Addition	*32,797.56
Acres of private land in EAR Area exclusive of KGRA Addition	**18,361.73
Total acres in EAR Area exclusive of KGRA Addition	***51,159.29
Total government acres on which EAR is being written	*46,015.39
Total private land acres within EAR boundary	**19,201.73
Grand total of private and government land within EAR boundary	***65,217.12

MINERAL ESTATE ACREAGE TOTALS

Lands in the KGRA Addition

Acres of government land with mineral estate owned by government	12,576.28
Acres of government land with mineral estate privately owned	641.55
Acres of private land with mineral estate privately owned	840.00
Acres of private land with mineral estate owned by government	-
Total acres in KGRA Addition	14,057.83

Lands in the EAR Area exclusive of KGRA Addition

Acres of government land on which mineral estate is owned by gov.	30,791.08*
Acres of government land on which mineral estate is privately owned	2,006.48
Total government acres in EAR Area exclusive of KGRA Addition	32,797.56
Acres of private land on which mineral estate is privately owned	12,300.84
Acres of private land on which mineral estate is owned by gov.	4,242.16
Acres of private land on which oil and gas estate is owned by gov.	1,818.73
Total private land in EAR Area exclusive of KGRA Addition	18,361.63

*on 920 acres of this total, the government owns only ¼ of all minerals
on 40 acres of this total, the government owns only ½ of all minerals

U. S. GOVERNMENT LAND WITHIN THE VALE KGRA ADDITION:

T.18S., R.45E., Wm. M.

Section 34	All

T.19S., R.45E., Wm. M.

Section 2	All
Section 3	All
Section 4	All
Section 9	All
Section 10	All
Section 11	All
Section 12	All
Section 13	All
Section 14	All
Section 15	All
Section 23	All
Section 24	All
Section 25	All
Section 26	All
Section 36	$S\frac{1}{2}$

T.19S., R.46E., Wm. M.

Section 19	All
Section 30	All

T.20S., R.45E., Wm. M.

Section 2	All
Section 3	All
Section 10	$N\frac{1}{2}$, $NE\frac{1}{4}SE\frac{1}{4}$, $E\frac{1}{2}NW\frac{1}{4}SE\frac{1}{4}$, $SW\frac{1}{4}SW\frac{1}{4}$
Section 11	$N\frac{1}{2}$

U. S. GOVERNEMENT LAND THAT LIES NEAR BUT OUTSIDE THE KGRA ADDITION:

T.17S., R.45E., Wm. M.

Section 19	All
Section 20	All
Section 21	All
Section 22	All
Section 23	All
Section 24	$S\frac{1}{2}$, $NW\frac{1}{4}$
Section 25	All except $SE\frac{1}{4}SE\frac{1}{4}$
Section 26	All
Section 27	All
Section 28	All
Section 29	All
Section 30	All except $W\frac{1}{2}SW\frac{1}{4}$
Section 32	All
Section 33	All
Section 34	All
Section 35	All

T.18S., R.45E., Wm. M.

Section 2	All
Section 4	Lots 1, 2, 3, 4, $S\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$, $NE\frac{1}{4}SW\frac{1}{4}$, $SE\frac{1}{4}$
Section 10	$N\frac{1}{2}$
Section 12	$NW\frac{1}{4}NW\frac{1}{4}$
Section 26	$SW\frac{1}{4}NW\frac{1}{4}$, $S\frac{1}{2}$

T.18S., R.46E., Wm. M.

Section 30	$SW\frac{1}{4}$, $W\frac{1}{2}W\frac{1}{2}SE\frac{1}{4}$

T.19S., R.44E., Wm. M.

Section 13	$SE\frac{1}{4}$
Section 24	$N\frac{1}{2}$, $N\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$
Section 25	$NE\frac{1}{4}NE\frac{1}{4}$

T.19S., R.45E., Wm. M.

Section 5	All
Section 6	$S\frac{1}{2}NE\frac{1}{4}$, $E\frac{1}{2}SE\frac{1}{4}$
Section 7	$NE\frac{1}{4}NE\frac{1}{4}$, $S\frac{1}{2}NE\frac{1}{4}$, $E\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$
Section 8	All
Section 16	$E\frac{1}{2}$, $SE\frac{1}{4}SW\frac{1}{4}$
Section 17	All
Section 19	All
Section 20	All
Section 21	All
Section 22	All
Section 27	All
Section 28	All
Section 29	All
Section 30	Lot 1, $E\frac{1}{2}$, $E\frac{1}{2}NW\frac{1}{4}$
Section 31	$E\frac{1}{2}$
Section 32	All
Section 33	All
Section 34	All

T.19S., R.46E., Wm. M.

Section 2	$SW\frac{1}{4}NE\frac{1}{4}$, $W\frac{1}{2}SE\frac{1}{4}$
Section 3	$SW\frac{1}{4}NW\frac{1}{4}$, $NW\frac{1}{4}SW\frac{1}{4}$
Section 7	Lots 1, 2, 3
Section 8	$S\frac{1}{2}SE\frac{1}{4}$
Section 17	$N\frac{1}{2}SW\frac{1}{4}$, $SW\frac{1}{4}SW\frac{1}{4}$, $NW\frac{1}{4}SE\frac{1}{4}$
Section 20	All
Section 28	$NE\frac{1}{4}NW\frac{1}{4}$, $N\frac{1}{2}NW\frac{1}{4}NW\frac{1}{4}$, $W\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}SW\frac{1}{4}$
Section 29	All except $NE\frac{1}{4}NE\frac{1}{4}$
Section 31	All
Section 32	$N\frac{1}{2}$, $SW\frac{1}{4}$, $NE\frac{1}{4}SE\frac{1}{4}$, $N\frac{1}{2}NW\frac{1}{4}SE\frac{1}{4}$
Section 33	$NW\frac{1}{4}$ lying north of canal

T.20S., R.45E., Wm. M.

Section 1	All
Section 4	All
Section 5	All
Section 6	Lot 1, $S\frac{1}{2}$, $SE\frac{1}{4}NE\frac{1}{4}$
Section 7	All
Section 8	All
Section 12	$N\frac{1}{2}$, $N\frac{1}{2}SE\frac{1}{4}$, $SE\frac{1}{4}SE\frac{1}{4}$
Section 14	$W\frac{1}{2}SW\frac{1}{4}$
Section 15	All except $N\frac{1}{2}NE\frac{1}{4}$
Section 17	All
Section 18	All

T. 20 S., R. 46 E., W. M.

Section 5 That portion lying above the canal except that portion west of Lytle Blvd. in SW¼NE¼ and that in SE¼NE¼

Section 6 All except SE¼SW¼, SW¼SE¼

PRIVATE LAND WITHIN THE EAR BOUNDARY ON WHICH THE FEDERAL GOVERNMENT OWNS THE MINERAL ESTATE:

T.19S., R.44E., Wm. M.

Section 24 $SE\frac{1}{4}SW\frac{1}{4}$
Section 25 All except $SW\frac{1}{4}SW\frac{1}{4}$, $NE\frac{1}{4}NE\frac{1}{4}$

T.19S., R.45E., Wm. M.

Section 1 All
Section 30 Lots 2, 3, 4, $E\frac{1}{2}SW\frac{1}{4}$
Section 31 Lots 1, 2, 3, 4, $E\frac{1}{2}W\frac{1}{2}$

T.20S., R.45E., Wm. M.

Section 6 Lots 2, 3, 4, 5, $SW\frac{1}{4}NE\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$
Section 14 $E\frac{1}{2}SW\frac{1}{4}$

T.19S., R.46E., Wm. M.

Section 2 Lots 2, 3, 4, $S\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}$
Section 3 $S\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$, $E\frac{1}{2}SW\frac{1}{4}$, $SW\frac{1}{4}SW\frac{1}{4}$, $SE\frac{1}{4}$
Section 6 All
Section 7 $N\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}NE\frac{1}{4}$, $E\frac{1}{2}NW\frac{1}{4}$, $NE\frac{1}{4}SW\frac{1}{4}$
Section 9 $S\frac{1}{2}SE\frac{1}{4}$
Section 10 $E\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}NW\frac{1}{4}$, $S\frac{1}{2}SW\frac{1}{4}$
Section 15 $NW\frac{1}{4}NE\frac{1}{4}$, $NW\frac{1}{4}$, $NE\frac{1}{4}SW\frac{1}{4}$

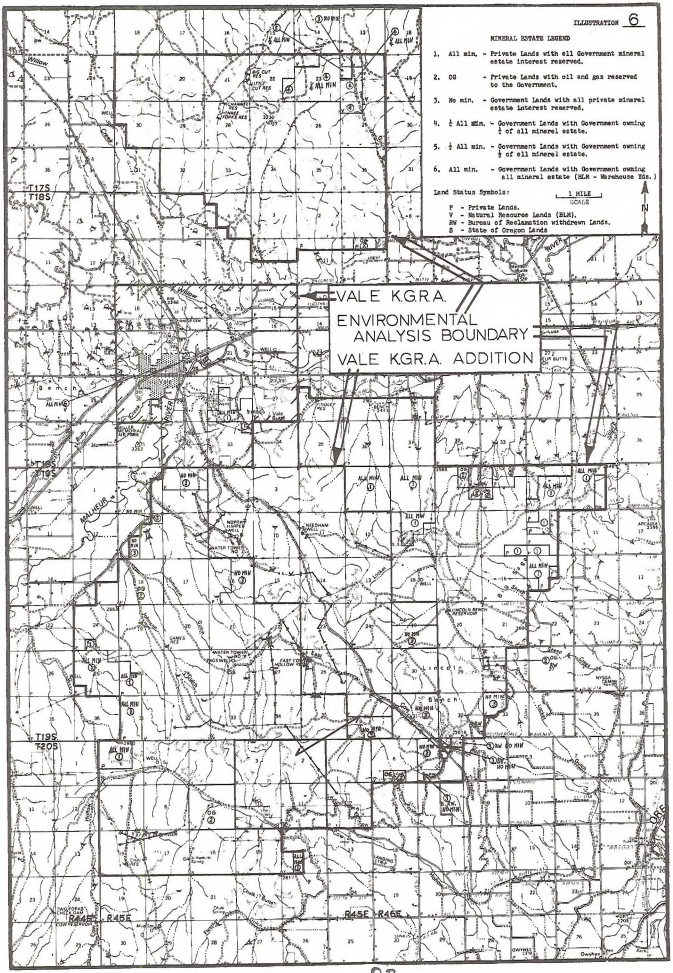


ILLUSTRATION 6
MINERAL ESTATE LEGEND
1. All min. - Private Lands with all Government mineral estate interest reserved.
2. OG - Private Lands with oil and gas reserved to the Government.
3. No min. - Government lands with all private mineral estate interest reserved.
4. ½ All min. - Government Lands with Government owning ½ of all mineral estate.
5. ½ All min. - Government Lands with Government owning ½ of all mineral estate.
6. All min. - Government Lands with Government owning all mineral estate (BLM - Warehouse Yds.)
Land Status Symbols:
P - Private Lands.
V - Natural Resource Lands (BLM).
BW - Bureau of Reclamation withdrawn Lands.
S - State of Oregon Lands
1 MILE
SCALE
N
VALE K.G.R.A.
ENVIRONMENTAL
ANALYSIS BOUNDARY
VALE K.G.R.A. ADDITION
T17S
T18S
T19S
T20S
R45E
R46E
R47E

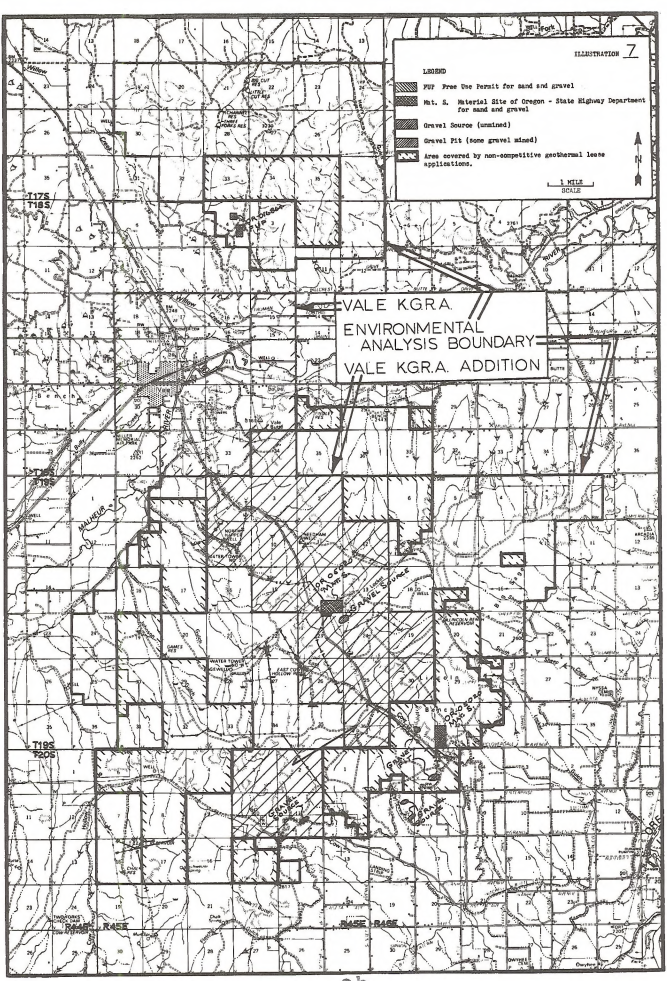


ILLUSTRATION 7
LEGEND
FUP Free Use Permit for sand snd gravel
Mat. S. Materiel Site of Oregon - State Highway Department for sand and gravel
Gravel Source (unmined)
Gravel Pit (some gravel mined)
Area covered by non-competitive geothermal lease applications.
1 MILE
SCALE
N
VALE K.G.R.A.
ENVIRONMENTAL ANALYSIS BOUNDARY
VALE K.G.R.A. ADDITION
GRAVEL SOURCE
FUP
Vale
T17S
T18S
T19S
T20S
R45E
R46E

What is Geothermal Energy?

Geothermal energy is the natural heat of the earth. Observations and deductions from mines and well data indicate that temperatures increase downward to between 392° F. and 1832° F., at the base of the earth's crust. The average heat flow of the earth is 1. 5 x 10^{-6} cal/cm^2/sec., but known local variations in heat flow of 15 times this average have been found. Abnormally high heat flow areas are prospectively valuable for geothermal resource development. These areas are frequently, but not always, marked by hot springs.

The natural heat of the earth is derived from radioactive decay, friction (tidal and crustal plate motion) and possibly primeval heat. Most of this heat is too diffuse to serve as a resource under present technology. Locally, however, it is concentrated in the crust by volcanism and magma chambers. This heat is stored in rocks and in water and steam within pores and fissures. This water and steam serve to transfer the heat to the earth's surface.

Geothermal Systems

There are in essence four different major types of geothermal systems: vapor-dominated systems, hot water systems, geopressured reservoir systems and hot dry rock systems. Most systems can be divided into two broad types on the bases of the fluid produced: The vapor-dominated or dry-steam type and the hot water type. Heat for both types is derived from a near-surface heat source such as a magma chamber.

Surface and near surface water percolating through fractures is heated by the hot rock and rises, sometimes appearing at the surface in the form of hot springs, geysers, fumaroles and other surface manifestations. The vapor dominated systems yield steam and other gases with little or no associated water. The hot water systems yield water and if the temperature is sufficiently high, some of the water flashes to steam, which can be directed through turbines to generate electricity. The commercial scale geothermal power development at The Geysers, California is a vapor dominated system. Most hot spring systems in the U. S., however, yield fluids that are dominated by hot water rather than steam.

Vapor dominated systems are believed to be relatively rare systems in which saturated steam and water are thought to coexist within the reservoir. The steam phase controls the pressure. With a decrease in pressure due to production through a well bore, the heat contained in the rock dries and superheats the steam. Commercial well production ranges from 50,000 to 300,000 pounds of steam per hour. Power production from vapor-dominated fields occur at The Geysers in California, Larderello, Italy and Matsukawa, Japan. The Valles Caldera field currently under development in northern New Mexico appears to be vapor dominated. At least one of the hot spring systems in Yellowstone National Park is of this type but is closed to development by virtue of the park status.

Hot Water systems are thought to be thermally driven convective systems in which percolating water picks up heat from the heat source and moves upward in the system. This upwelling of hot water often comes to the surface and is manifested as hot springs, geysers and other thermal phenomena. Thermal energy is stored both in the hot rock and in the water and steam which fill the pore spaces in the rock. Tapping of the upwelling hot waters by wells results in a portion of the fluid, generally 15 to 25 percent, flashing to steam due to pressure decrease. Temperatures of about 588° F. and wellhead pressures of about 50 to 150 psi are commonly found in this type of system. The steam fraction is separated from the hot water at the surface. Steam is directed through the turbines and the hot water is discharged to the surface or reinjected into the ground. Electric power production from this type of system is presently underway at Wairkei, New Zealand, Otaka, Japan, Cerro Prieto, Mexico and Pathe, Mexico.

Geopressured reservoir systems - Geopressured zones consist of highly porous sands saturated with brines of high temperature and under very high pressure. They are located principally along the Louisiana Coast and offshore of southern Texas. These zones are thought to occur as a result of normal heat flow being trapped under compacted layers of clay which serve as an insulating layer. The clay layer is derived from marine sediments that have been chemically altered by intense heat and pressure. The liquid in the trapped sand results from water being forced down through the clay layer by intense pressure from above. The geopressured zones are found at depths of 6,500 to 10,000 feet. Temperatures up to 569° F. and pressures up to 500 atmospheres have been measured in these systems. Difficult technical and economic problems must be solved before this system may prove useful for the generation of electric power. Of prime concern is the capability of the reservoir to supply a sustained source of steam or very hot water to warrant the construction of a power plant. This system is still being developed.

Hot dry rock systems consist of impermeable rocks overlying a local heat source such as a magma chamber. A much larger volume of hot dry rock is located in the earth's crust at depths in excess of 50,000 feet, beyond present drilling capability. Some shallow hot rock systems such as one suspected to occur near Marysville, Montana, are subject to current research. Because of the absence of water in these systems, water would have to be introduced through wells and fractures in the rock between the wells. Steam brought to the surface will be used to run conventional turbines for the generation of eletric power. Development of this system is in the early research state. Production of electric power from this system is probably years in the future.

Development of Geothermal Resources

Development and production of geothermal resources involve six phases: exploration, test drilling, production testing, field development, powerline construction and full scale operations. Each successive step is dependent upon successful results in the previous phases. Because of limited knowledge of the occurrence, location and properties of geothermal resources as related to both energy and by-product water and mineral materials, it is not possible in this analysis to specifically predict the success or failure of the KGRA or to make a categorical prediction about the program as a whole.

The following are general processes involved in the six phases of geothermal development:

Exploration

The exploration of geothermal areas is designed to locate and define commercial geothermal reservoirs and to evaluate the impact of possible geothermal development upon the environment, including surface and subsurface resources and various land uses. Principal exploration activities include topographic and geologic mapping, geologic field examinations, ground and spring temperature surveys, geochemical studies, geophysical surveys and shallow drilling for the purpose of sampling shallow ground waters, temperature measurement and subsurface rock sampling. These exploration activities are surface oriented investigations which include:

-Geochemical surveys where water and vegetative samples are obtained and analyzed for their chemical content.

-Stratigraphic, lithologic and structural mapping where a geologist assisted by a survey crew examines the rock outcrops and topography in an area and makes deductions about the subsurface geology.

-Micro gas surveys where air samples are obtained from various points within a given area.

-Reconnaissance surveys where the surface features and natural phenomena are examined without disturbing the land.

-Shallow drilling of holes 500 feet deep or less required for geophysical data.

Generally these surveys are by use of existing roads and trails.

More intensive use of the land in this phase is not uncommon. New roads, clearings, etc., may be required in the search for evidence of geothermal indicators.

Test Drilling

Locations for the drilling of test wells are selected on the basis of preliminary exploration work, an approved exploration plan and other data. Test wells provide sub-surface geologic data, locate potential productive zones within the geothermal reservoir, help delineate the reservoir limits and aid in determining the physical and chemical properties of the reservoir and reservoir fluids.

Test wells may vary, depending on the geological conditions and the objectives, from boreholes with diameter of about four inches to 24 inches and in depth from a few hundred to several thousand feet, with the deepest in the 5,000 to 10,000 foot range. The equipment and the control measures for drilling, sampling and completion have to be appropriate to the specific situations. Where the principal objective is to outline prospective areas by collecting data on thermal gradients or geologic structure and steam producing zones will not be penetrated, small diameter boreholes may be put down by small or medium sized drill rigs to a depth of about 2,000 feet. For test wells intended to investigate the potential reservoirs with large diameter and deeper boreholes, the current drilling equipment, technology and methods are similiar to those used in oil and gas operations.

The test drilling equipment used often is a truck mounted drilling rig. A truck mounted air compressor is usually used if the drilling is done with air; or a water tank truck if the drilling is done with water. The drill site occupies an area of approximately 40 x 60 feet. In some cases a drilling rig with a conventional substructure is used. The drill site (or pad) generally involves an area of less than an acre which may be cleared of vegetation and graded to a flat surface. The drilling rig, mud pumps, mud tanks, generators, drill pipe rack, tool house, etc. usually are located on the drill pad. Other facilities, such as storage tanks for water and fuel may or may not be on the drill pad; however, they will be nearby. A reserve pit of approximately 1,000 square feet and 6 to 8 feet deep is sometimes dug to contain waste fluids during drilling operations. Where larger and/or deep holes are to be drilled, larger equipment is required. It may be necessary to construct a heavy duty road that can support the drilling rig and other equipment that must be moved to the location. The largest individual truck anticipated will weigh approximately 90,000 pounds. The larger drill rig and associated equipment and material will occupy a larger site, often 400' x 200' and sumps may be as large as 3,600 square feet.

Production Testing

Production testing is the transitional phase between exploration and potential development and production of a geothermal reservoir. A well that has penetrated a potentially productive geothermal zone is completed and tested over a period of time to clean out the well and to determine

the flow rate, composition and temperature of fluids and gasses, recharge characteristics, pressures, compressibility and other physical properties of the reservoir fluids. Testing requires that the maximum production rate of the well be established by various controlled production rates over sufficient time to establish the hydrodynamic properties and/or boundary characteristics of the reservoir. This process involves venting of the well to the atmosphere with accompanying vapor release and noise.

During production testing, considerable monitoring and analytical work will be necessary and required to determine the quantity of potentially toxic substances present in geothermal fluids, to evaluate potential hazards which its presence may create and to establish the control measures to be imposed to assure meeting environmental and public health and safety requirements.

In the event that exploratory drilling and production testing indicates that a geothermal field has economic potential for power development, a commitment must be obtained from a customer electric utility to warrant further development. This would be a major decision point in the development and production of the geothermal resource of a given area. Additional permits would be required for construction of industrial facilities and for road and powerline rights-of-way on Federal land off the lease site.

Field Development

Favorable exploration, test drilling and production testing programs will probably lead to the drilling of a number of additional wells to develop a field. Access roads will be improved to give permanent service.

Limited service and living quarters will be constructed if required and adequate water sources and sewage facilities will be provided.

Field development in a large field can continue for many years as new wells and additional power generating units are developed.

The drilling for geothermal fluids will continue to include test wells and intensive production testing as the limits of the field are probed. In these wells, uncertainties as to the depth of the producing zone and type of fluids to be encountered will be less than in the initial prospecting stages. The bulk of this drilling will take place between proven wells under more predictable conditions.

If the geothermal fluids and gasses contain substances that are found to be detrimental if discharged at the surface, the contaminating substances must either be removed, neutralized, or reinjected into the appropriate subsurface reservoir. If no harmful materials are present, or if these materials can be economically removed, it is possible that fresh water

may be a by-product of energy production at a geothermal plant. Conservation and utilization of such demineralized water will be required where such production is economically feasible.

To the extent that wells produce geothermal fluids, it also may be necessary to carry out an injection well program in close coordination with the production wells.

The technique of injecting liquids deep within the earth have been in use for many years in the petroleum industry. Indeed this is one of the basic methods of secondary recovery and maintenance of proper reservoir pressures. Adaptation of these techniques to reinjection of geothermal fluids may require some slight modifications, but should be well within the realm of existing technology.

Power Plant and Power Line Construction

Power generation and transmission facilities will be constructed in stages to establish the most efficient size for the project in relation to the associated geothermal reservoir. Under present technology, above ground insulated pipes are used to transport the steam from the well to the power plant because of pronounced thermal pipeline expansion and contraction during operation. An underground pipe system is not economically feasible owing to service and equipment requirements. Since geothermal fluids and steam can be transported only a distance of about one mile due to pressure and temperature loss factors, power plant installations will be relatively small, probably not exceeding 100 mega watts at individual sites. A typical power plant at The Geysers consists of two turbine generators housed in a single building with an adjoining structure housing cooling towers. Geyser units 3 and 4 are housed in a building 140 feet by 36 feet and 30 feet high. Adjoining is a cooling tower consisting of three 36 feet by 66 feet shells. Surface steam lines of 10 to 30 inches, fiberglass and asbestos insulated pipe with characteristic large U-shaped expansion loops, connect the wells to the power plant. The greatest distance of any connected well currently is 1,200 feet in a straight line. Each plant is served by several producing wells at spacings of about 40 acres per well. Thus, in the producing area, the terrain is laced with exposed steam pipes radiating out from the power plants which in turn are connected together with high voltage transmission lines.

Full Scale Production

During the production period, activities primarily will consist of the operation and maintenance of the power plant and related facilities and the drilling, redrilling, and work over of geothermal wells to maintain production capacity. Electrical energy generation will be at its maximum during this stage. Overall activity will be considerably reduced over that

required during field development and the construction of power generation, power transmission, and related facilities. The adverse environmental effects of geothermal development may decline as the field comes into full-scale production. If proper environmental measures have been fully implemented during the construction phase, vegetative cover will begin to cover exposed soils where conditons are conducive to plant growth, drainage and soil erosion measures will control run-off to minimize both on and off site damage. The physical disturbances and activities asrociated with construction will have ended. A state of use equilibrium will be reached which will be conducive to broader multiple land uses, particularly uses such as wildlife habitat, grazing, and agriculture. The Larderello Field in Italy, for example, is in an area of intensive agricultural development. Within the confines of the geothermal field, there are many farms, vineyards, and orchards adjacent to producing wells, pipelines, and power plants.

ALTERNATIVES TO THE PROPOSED ACTION

1. Do not lease any of the Federal land in the EAR Area for geothermal purposes.

   It is felt no description of this alternative is needed since use of the area will remain the same.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Non-living:

Climate

The climate is typical of eastern Oregon with hot, dry summers and cold, wet winters. Precipitation and temperature data from Vale, Harper and Owyhee Dam is listed in Tables 1, 2, and 3. The Vale station is within Vale, Harper is 25 miles west of Vale and Owyhee Dam is 24 miles south of Vale.

Annual precipitation averaged 9.65 inches at Vale based on 23 years of record. (1930 through 1972). Approximately 60 percent of this precipitation is received October through March. The majority of the remaining precipitation falls during the spring months. An annual average of 20 inches of snow falls during the months of November, December, January, February and March.

The prevailing winds are north to northwest.

Topography

The topography of the environmental analysis area is characterized by rolling plateaus dissected by several intermittent drainages. The Malheur River and adjacent flood plain separate the two plateau areas. Elevation ranges from 2242 feet at the town of Vale to 3200 feet. Slopes vary from nearly level to very steeply-sloping.

TABLE 1

Mean Monthly and Annual Precipitation (in inches)

Station	No. years recorded	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Owyhee Dam	20	.86	.75	.68	.65	1.27	1.10	.22	.56	.64	.65	.83	.94	8.61
Vale	19	1.15	.90	.70	.70	1.26	.86	.17	.63	.56	.76	1.00	1.20	9.65
Harper	15	1.16	.78	.82	.71	1.09	1.07	.15	.52	.45	.89	.90	1.03	9.10

TABLE 2

Mean Maximum Temperatures

Station	No. Years Recorded	Monthly J	F	M	A	M	J	J	A	S	O	N	D	Annual
Owyhee Dam	11	40.4	48.7	56.9	65.1	75.1	84.9	95.3	91.5	81.0	68.6	52.4	41.6	66.8
Vale	11	39.3	47.4	56.5	65.9	75.9	85.8	96.1	91.9	81.0	68.0	51.5	40.5	66.7
Harper	11	38.4	46.9	56.0	64.4	73.0	81.9	92.2	88.9	79.6	67.0	51.0	40.4	65.0

TABLE 3

Mean Minimum Temperatures

Station	No. Years Recorded	Monthly J	F	M	A	M	J	J	A	S	O	N	D	Annual
Owyhee Dam	11	23.7	29.5	32.3	37.7	43.8	50.1	53.7	53.3	47.6	39.5	31.6	25.1	39.0
Vale	11	20.9	25.6	28.3	34.4	42.4	50.7	56.1	53.4	44.6	34.3	28.1	21.7	36.7
Harper	11	18.7	24.5	25.8	31.5	39.3	47.8	51.9	50.5	41.5	31.4	25.6	20.3	34.1

T A B L E 4

FROST FREE SEASON

Mean Number of Days With Temperature 32°F +

Station	No. Years of Record	Mean No. Frost Free Days		
Owyhee Dam	31	170	20% weighted	34
Vale	32	149	50% weighted	75
Harper	26	123	30% weighted	37

Weighted # frost free days 146

SOILS

The soils of the Area are the Nyssa - Frohman - Malheur series.

The Nyssa series are moderately deep, well drained soils with a weakly cemented pan formed on high terraces. They are underlain by lacustrine materials or old alluvium and mantled by thin loess. Slopes of the land in this series are 7-20 percent. Soils of this series make up the majority of the soils in the area.

Associated with the Nyssa soils in the southern portion of the area are the Malheur soils. These occur in a complex pattern of sodium affected "slick" spots interspersed with the Nyssa soils.

The Frohman series are shallow, well drained soils derived from thin loess and old alluvium on a nearly level to sloping high terrace. Slope varies on the lands in this series from 0 to 12 percent.

Unnamed soils in the northern end of the area (north of Vale) are moderately fine textured, deep, well drained soils on gently sloping to hilly uplands. Interspersed among these soils are raw lacustrine sediments occurring on exposed areas along incised drainages.

Additional information on the soils of the area can be found in the General Soil Map Report published by the Oregon State Water Resources Board in 1969. Copies of the report are located in the District's library.

A detailed description of these soils is located in Appendix VII.

Slight to moderate erosion is occurring in the area. The soils are susceptible to both wind and water erosion whenever protective vegetative cover is reduced or removed. Wind erosion especially, becomes a serious problem when vegetative cover is removed.

No pollutants are known to occur in the soils.

Air

Presently air quality is generally high. One exception is during the non-irrigation season. During this time, bare crop land is susceptible to wind erosion, with resultant dust storms, as low pressure centers with accompanying winds move through the area. Dust storms commonly occur during the time prior to or at the conclusion of the irrigation season, as fields are being or have been, worked in preparation for crop planting. This is not a major problem or source of pollution.

A second pollution source is from smoke during range fires and from burning trash on agricultural lands. This is not a significant source of pollution and is a minor problem except during periods of temperature inversion.

Water

The Malheur River, a tributary of the Snake River, flows between the two parts of the area. Water quality of the Malheur River is low at present and intensive irrigation use degrades it further. This stream is seasonally warm, high in sediment and dissolved solids. Concentrations of basic nutrients, nitrogen and phosphorous, are high; phosphorous concentrations are particularly high. High nutrient concentrations have stimulated heavy algal growth. Concentrations of dissolved solids in the Malheur average over 1,000 mg/l. Bacterial contamination of the Malheur also exists. Dissolved oxygen concentrations fluctuate with low flows and algal activity. One in ten year low flow for the Malheur is as low as 32 cfs for a period of one month.

However, sediment and dissolved solid contributions to the Malheur from National Resource Lands within the EAR area are insignificant.

Several ground water aquifers exist within the EAR area. Quality of water varies among the aquifers; some waters are not potable. Some deeper wells 500-600' produce warm water. Most potable wells within the town of Vale are 20-40'.

The shallow wells are located in flood plain alluvium of the Malheur River.

GEOLOGY

1. Stratigraphy

The oldest rocks in the area of the EAR are of Miocene age and belong to the Deer Butte Formation. The formation is fairly widespread in the Kern and Sourdough Basins about 20 miles southwest of Vale. Here it consists of fine-grained tuffaceous sediments with a few interbedded basalt flows in the lower part and grades upward into massive sandstones and conglomerates. The Deer Butte Formation was deposited on a dissected erosion surface so the total thickness varies considerably. The maximum thickness of the lower member is unknown, but is at least 415 feet while a maximum thickness of 1248 feet has been measured in the upper member (Corcoran, R. E., and others, 1962, P.7). The only exposure of the Deer Butte Formation within the area of the EAR is in Vale Butte where the well-cemented arkoses and conglomerates characteristic of the upper part of the unit form the butte as an erosional remnant. However, the formation almost certainly underlies the entire area.

The sandstones are composed primarily of quartzite, quartz, and chert grains with some plagioclase feldspar. The conglomerates have cobbles up to six or eight inches across and are composed predominantly of granites, rhyolites, quartzites and quartz. The source area for the Deer Butte Formation is not definitely known, but it appears to be about 35 miles to the southeast in the vicinity of Silver City, Idaho. Here, there is a mineralized granite stock about 10 miles wide by 25 miles long which seems a likely source for the quartz and feldspar present in the formation. Fossil leaves, bones and fresh water mollusks have been found in the formation but the vertebrate remains appear to be the most diagnostic and according to Shotwell are of Barstovian (upper Miocene) age. (Johnson, Arvid, 1961).

Overlying the Deer Butte Formation in the EAR area is the Chalk Butte Formation of Pliocene age. The Chalk Butte is a part of the larger Idaho Group which is also composed of the Kern Basin Formation and the Grassy Mountain Basalt. Of the Idaho Group, only the Chalk Butte Formation is present in the EAR area. Rocks of the Chalk Butte are the most abundant type at the surface within the EAR area and probably represent about 70% of the surface exposure. The formation is mostly sedimentary and the predominant lithologic types are tuffaceous sandstones, siltstones and conglomerates with lesser amounts of tuff ash beds and fresh water limestone. Interbedded basalt flows, generally less than 30 feet thick, are fairly common but are very local and lenticular so are not useful for correlation. A partial thickness of 538 feet has been measured at the type locality in SE¼, Section 22, T. 20 S., R. 45 E. However, the faulting present in the area and the

relatively unconsolidated nature of the deposit, make the true thickness difficult to obtain. The environment of deposition apparently fluctuated from fluviatile (stream deposited) to lacustrine (lake deposited) with the lacustrine environment predominating in the EAR area.

Although the Chalk Butte is very poorly consolidated and weathers to gently rounded hills and valleys, the silt content seems to predominate over clays because there is very little evidence of landsliding. In the area north of Vale and in parts of the area south of town, there is some aeolian erosion but many former dune areas are now becoming stabilized by vegetation.

Fresh water mollusks and leaves have been collected from the Chalk Butte and J. A. Shotwell has assigned a middle Pliocene (Hemphillian) age to vertebrate fossils from the type locality of Chalk Butte. (Corcoran, R. E., 1962, P.7). Terrace gravels are found capping a good number of the ridges throughout the area but are especially numerous along and east of Lytle Boulevard. These gravels are of Pleistocene and possibly upper Pliocene age and represent the erosional remnant of a once more widespread gravel floodplain of the Owyhee and Malheur rivers. Thicknesses range up to 50 feet or more and are composed of poorly to moderately consolidated basaltic, quartzitic, and chert pebbles and cobbles. Sorting ranges from fair to poor and cementing material often consists of white caliche layers that both make the gravel hard to quarry and chemically undesirable for concrete aggregate.

2. Structure

The EAR area lies in the western extremity of the depression known as the Snake River downwarp. This large structural trough, presently occupied by the Snake River, extends from Yellowstone Park in Wyoming across southern Idaho and into eastern Oregon. Continuing studies indicate the large down-dropped fault block, or graben, may be comparable in size and complexity to the Rhone Valley of Germany and the rift valleys of East Africa. The large structural trough is bounded by nearly vertical faults. The basin apparently gradually sank during the Miocene and Pliocene to receive thousands of feet of sediments. The fault system associated with the structure is only now becoming fully appreciated through recent geophysical exploration. There are many more faults, trending mostly north-south, in the Vale area than previously thought. Displacements are very difficult to determine from surface observations because of the "healing" effects of the poorly consolidated Chalk Butte Formation, but probably range in hundreds of feet. The downthrown side is usually to the east but the Lytle Boulevard area may be an exception with the Vale Buttes - Lincoln Bench area being upthrown with respect to the area west of Lytle Boulevard. This would account for the exposures of the Deer Butte Formation in Vale and Rhinehart Buttes. Formational dips in the EAR area generally range from two

to five degrees to the northeast but are locally steeper near faults.

3. Economic

a. Minerals

Aside from sand and gravel there has been no significant mineral production from the EAR area. A group of claims were staked in 1955 by two local men but there is no evidence of claim posts being maintained or of assessment work ever having been done. The recorded location of the claims places them in the Chalk Butte tuffaceous sandstones. There are no known mineral values in these sediments, but there was extensive claim staking for uranium in the Vale area as well as throughout the Western United States during the 1950's and these claims were probably only speculative for uranium with no evidence of mineralization.

Sand and gravel of varying quality is widely distributed at the higher elevations throughout the EAR area. A number of gravel pits have been opened in the area (See Illustration 7.) Most of the material has been used by the Oregon State Highway Department and Malheur County for road construction. Appreciable amounts have also been used by the various irrigation districts for lining canal banks to stop erosion. Much smaller quantities have been utilized by individuals for various uses. The abundance and wide distribution of gravel should mean that adequate sources will be available for local uses regardless of geothermal development. Indeed, the gravel will be a highly useful material in road, drill site, and power plant construction if development does proceed. Cut and fill from new road construction may well expose new deposits that would permit closing and rehabilitation of some existing pits that are not aesthetically pleasing.

b. Oil and Gas

Exploration for oil and gas has taken place in the Vale area of Malheur County since the early 1900's. Activity has been sporadic and tied to periodic increases in exploration nationwide. Several shallow wells provide gas for ranches and varying quantities of gas have been discovered in many of the test wells but none have produced commercial quantities for sustained periods.

In 1954, El Paso Natural Gas Company drilled the deepest hole in the Western Snake River basin to 7,470 feet (Newton, V.C and Corcoran, R.E., 1963, P. 10). The unsuccessful hole was about eight miles west of the Vale KGRA Addition. In spite of the approximately 30 dry holes drilled in northern Malheur County, the drill spacing is still quite low when compared to other

"wildcat" areas that have subsequently entered production. Since geothermal drilling will involve deep test holes, this structural and stratigraphic information could well encourage renewed oil and gas exploration.

c. Geothermal

The Vale Hot Springs was a well-known rest stop for early travelers over the historic Oregon Trail. Later, a swimming pool was developed on the site and presently the Vale Floral Shop and several surrounding residences use the hot water for space heating.

The area has also been the subject of considerable interest for geothermal power. See Illustration 7 for the non-competitive geothermal lease applications within the area shown on the map. A number of major energy companies have leased private lands around the area of the EAR and have conducted geophysical and geologic studies on both National Resource and private lands. The Oregon Department of Geology and mineral Industries has conducted temperature gradient studies all around Vale, including the area of the EAR, and the EAR area has heat flows up to 6.9 cal/cm^2 sec or 230^{o} C/km. These values are thought to be among the highest in the western United States (Bowen, R. G., 1972, p. 6).

Oregon State University conducted a seismic reflection and refraction survey south of Vale, including the area of the EAR, in the fall of 1974 but results are not yet published.

The U. S. Geological Survey is presently conducting studies on the chemical composition and estimated minimum thermal reservoir temperature of the Vale Hot Springs. Preliminary date indicates the reservoir temperature may be among the highest in Oregon. All such estimates are only inferences from available data and the only positive assurance of a geothermal energy source is a drill test and subsequent direct fluid temperature measurements as well as other reservoir property measurements.

Magma Energy Inc., has prepared a drill site on private lands one mile north of the EAR area but as of January 1, 1975, there has not been a geothermal drill test in Malheur County, Oregon.

d. Ground Water

Data on the ground waters in the EAR area are available for only two stock water wells. These are the BLM North Harper and Page Wells (See Illustration 7). Static water level in the North Harper Well is approximately 600 feet or a water table elevation of 2200 feet. The well has a total depth of 696 feet, a yield of approximately 8 gallons per minute and the maximum surface temperature of the water after pumping was 92^{o}F. The Page Well has

a total depth of 622 feet, a static water level of 434 feet, or a water table elevation of 2415 feet. The well yields approximately 12 gallons per minute and a maximum surface temperature of the water after pumping was measured to be 80°F. The low yields are due to the fine grained nature and resultant low porosity and permeability of the Chalk Butte tuffaceous sandstones. Yields may be greater in the vicinity of the many faults which traverse the area.

References

Bowen, Richard G., 1972, Geothermal Activity in 1972 Ore Bin, V. 35, No. 1, p. 6.

Corcoran, R. E. and others, 1962, Geology of the Mitchell Butte Quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS2, p. 7.

Johnson, Arvid, 1961, Stratigraphy and Lithology of the Deer Butte Formation, Malheur County, Oregon: Oregon University Masters Thesis.

Newton, V. C. and Corcoran, R. E., 1963, Petroleum Geology of the Western Snake River Basin, Oregon-Idaho: Oregon Department of Geology and Mineral Industries, Oil and Gas Investigations No. 1, p. 10.

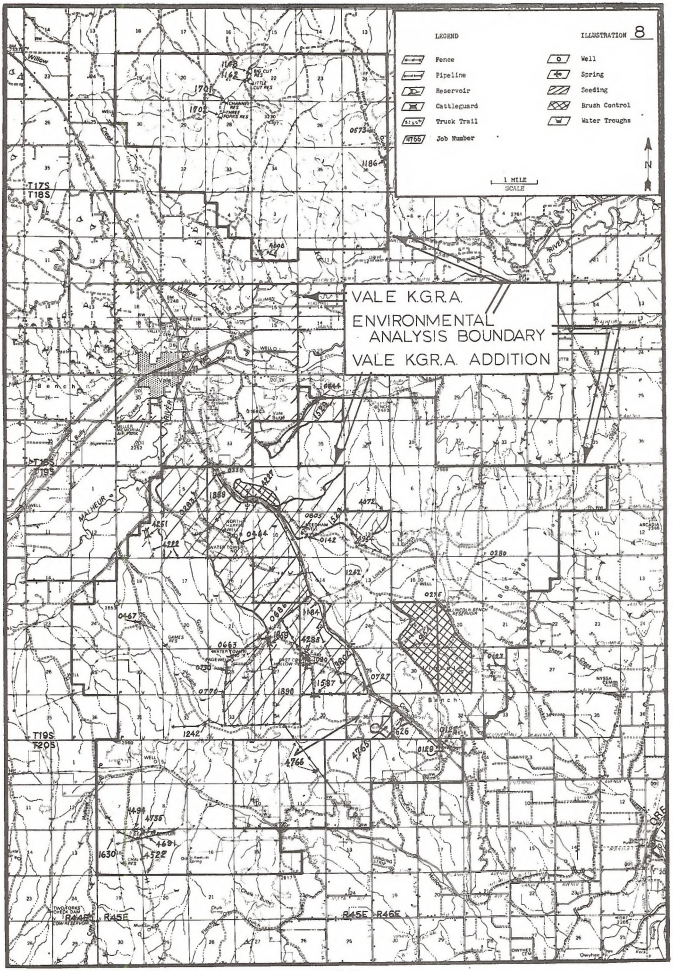
B. Living

Vegetation

The entire analysis area is considered to be a part of the Cold Desert Biome. The vegetation on federal land is typically that of the big sagebrush (Artemesia tridentata), bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis), squirrel tail (Sitanion hystrix), climatic climax plant community. The topography of the area provides a wide variety of small vegetative habitats due to different exposures to solar radiation, slope of the land, and differences. The more arid or xeric habitats often support spiney hop-sage (Grayia spinosa), and a limited amount of purple sage (Salvia cornosa), fourwing saltbrush (Artiplex canescens), and horsebrush (Tetradymia spp.). Less arid or more mesic exposures support small populations of antelope bitterbrush (Purshia tridentata), and associated perennial bunchgrass species, especially bluebunch wheatgrass and Idaho fescue.

A century of abusive vegetative utilization by domestic livestock has converted the majority of the bluebunch wheatgrass understory to one of annual grasses, notably cheatgrass (Bromus tectorum); annual forbs, especially mustards (Sisymbrium spp.), and peppergrass (Lepidium perfoliatum); and has increased the abundance of rabbitbrush (Chrysothamnus spp.) and big sagebrush in the shrub overstory. The more flammable annual species facilitated frequent wild fires to further alter the vegetative community toward sub-climax or seral vegetation. As a result of the Vale Range Rehabilitation Project which began in 1962, several large areas within the analysis area boundary have been subjected to land treatment practices. The practices include plowing and seeding introduced grass or spraying with herbicide for brush eradication. These areas and the specific practices employed are delineated on Illustration 8 and the range improvement job summary on Illustration 9. Most seeded areas now consist chiefly of a crested wheatgrass, (Agropyron cristatum). Sandberg's bluegrass, (Poa secunda) community with scattered plants of big sagebrush and rabbitbrush interspersed. Composition in brush eradication areas consists of somewhat less density of sagebrush with a composition of grass species representative of the better condition untreated areas. The predominant grass species of the untreated area at present is Sandberg's bluegrass. It is likely that this species has replaced bluebunch wheatgrass during the long history of abusive livestock use and wild fire vegetative changes.

Bluebunch wheatgrass can still be found in areas less accessible to livestock and areas furthest from water such as ridge and hilltops, rock piles, and rimrock ledges. Other plant species that can be found in the area are Indian Ricegrass (Oryzopsis hymenoides), needle and thread (Stipa comata), giant wild rye (Elymus cinereus), creeping wild rye (Elymus triticoides), wild mustard (Brassica spp.), balsamroot (Balsamoriza sagittata), Russian thistle (Salsola kali), Scotch thistle (Onopordum acanthium). The undisturbed litter under sagebrush provides habitat for mosses. The exposed surfaces of most rock have lichen growing on them.


LEGEND
ILLUSTRATION 8
Fence
Pipeline
Reservoir
Cattleguard
Truck Trail
Job Number
Well
Spring
Seeding
Brush Control
Water Troughs
1 MILE
SCALE
N
VALE K.G.R.A.
ENVIRONMENTAL
ANALYSIS BOUNDARY
VALE K.G.R.A. ADDITION
T.17S.
T.18S.
T.19S.
T.20S.
R.44E.
R.45E.
R.46E.

RANGE IMPROVEMENT SUMMARY
VALE KGRA ADDITION

JOB NO.	JOB NAME	UNITS	YEAR	COST
0275	Lincoln Bench Reservoir	1.0 each	47	$ 546.00
0123	North Harper Drift Fence	1.3 miles	44	205.00
0129	Owyhee Siphon Cattleguard	1.0 each	44	102.00
1626	Cow Hollow Division Fence	1.9 miles	67	1,456.00
0280	Lincoln Bench Truck Trail	8.0 miles	47	546.00
0464	North Harper Well Pipeline	11.2 miles	67	21,624.00
0805	Needham Well	1.0 each	55	194.00
0142	Lockett Gulch Reservoir	1.0 each	44	815.00
1859	East Page Well Cattleguard	1.0 each	68	504.00
0730	Page Well Cattleguard	1.0 each	64	501.00
0663	Page Well Pipeline	9.7 miles	68	5,535.00
0770	Page Seeding Protective Fence	14.6 miles	64	10,406.00
0727	Cow Hollow Cattleguard	1.0 each	64	501.00
0338	North Harper Cattleguard	1.0 each	63	356.00
1889	North Harper Seeding Division Fence	1.6 miles	68	1,193.00
1242	Gravel Ridge Division Fence	2.4 miles	65	1,550.00
1184	Lytle Boulevard Cattleguard	1.0 each	66	834.00
0467	Johnson Reservoir	1.0 each	63	472.00
1587	Burnt Ridge Cattleguard	1.0 each	66	546.00
4766	Boulevard Fence	2.0 miles	73	2,500.00
4072	Dunlevey Sayers Fence	1.6 miles	70	2,040.00
4251	Sand Hollow Cattleguard	1.0 each	70	356.00
4285	East Cow Hollow Reservoir	1.0 each	44	498.00
1090	Burnt Flat Cattleguard	1.0 each	65	491.00
1890	Page Well Seeding Division Fence	2.0 miles	67	1,419.00
4691	Ridge Line Fence	1.6 miles	72	2,770.00
4735	Mud Springs Pipeline Extension	1.6 miles	73	1,440.00
1494	Leaky Reservoir	1.0 each	66	1,476.00
0644	Findley Reservoir	1.0 each	54	200.00
1702	Three Forks Reservoir	1.0 each	67	1,231.00
1701	Channel Reservoir	1.0 each	67	1,036.00
1148	Big Cut Reservoir	1.0 each	66	1,144.00
1162	Little Cut Reservoir	1.0 each	66	813.00
1186	Willow Reservoir	1.0 each	58	900.00
0573	Henry's Gulch Spring	1.0 each	52	47.00
4008	Jordan Waterhole Pipeline	.1 mile	70	20.00
0283	North Harper Seeding	2687.0 acres	68	10,045.00
0686	Page Seeding	4400.0 acres	63	14,987.00
1529	Needham Well Seeding	995.0 acres	66	3,799.00
1954	Lincoln Bench Brush Control	1700.0 acres	68	8,110.00
3802	East Cow Hollow Seeding	825.0 acres	69	3,192.00
4227	North Harper Brush Control	260.0 acres	62	625.00
4765	Boulevard Seeding	175.0 acres	73	700.00
4954	Lockett Fence	3.3 miles	53	2,000.00
		Total		$109,725.00

Animals:

The EAR Area has a rather limited species variety of fauna due, in part, to the small and similar character of the land area involved. The land in the EAR Area affords either yearlong or part time habitat for the following species:

Mammals:

Order	Latin Name	Common Name
Insectivora	Sorex vagrans	Wandering shrew
	Sorex merriami	Merriam shrew
	Sorex preblei	Malheur shrew
Chiroptera	Myotis lucifugus	Little brown bat
	Myotis californicus	California bat
	Myotis evotis	Big-eared bat (Myotis)
	Myotis subulatus	Small-footed bat
	Myotis yumanensis	Yuma bat
	Antrozous pallidus	Palid bat
	Eptesicus fuscus	Big brown bat
	Lasiurus cinereus	Hoary bat
	Pipistrellus nesperus	Western pipistrel
	Plecotus townsendi	Western big-eared bat
Lagomorpha	Lepus californicus	Black-tailed jackrabbit
	Sylvilagus nuttalli	Mountain cottontail
	Sylvilagus idahoensis	Pygmy rabbit
Rodentia	Eutamias minimus	Least chipmunk
	Spermophilus townsendi	Townsend ground squirrel
	Ammospermosphilus leucurus	Antelope ground squirrel
	Marmota flaviventris	Yellow-bellied marmot
	Neotoma cinerea	Bushy-tailed woodrat
	Onychomys leucogaster	Grasshopper mouse
	Peromyscus maniculatus	Deer mouse
	Peromyscus crinitus	Canyon mouse
	Reithrodontomys megalotis	Harvest mouse
	Microtus longicaudus	Long-tailed vole
	Lagurus curtatus	Sage vole
	Erethizon dorsatum	Porcupine
	Zapus princeps	Western jumping mouse
	Dipodomys ordi	Ord kangaroo rat
	Microdipodops megachephalus	Dark kangaroo mouse
	Perognathus parvus	Great basin pocket mouse
	Thomomys talpoides	Northern pocket gopher

Carnivora	Lynx rufus	Bobcat
	Canis latrans	Coyote
	Vulpes fulva	Red fox
	Mustela frenata	Long-tailed weasel
	Taxidea taxus	Badger
	Mephitis mephitis	Striped skunk
	Spilogale gracitis	Spotted skunk
	Procyon lotor	Raccoon
Artiodactyla	Antilocapra americanus	Pronghorn antelope
	Odocoileus hemionus	Mule deer

Grazing by domestic cattle and sheep occurs in the analysis area. A portion of one fenced individual allotment, four community allotments, and some federal range fenced in with private rangeland are within the area. Also sheep trailing use is made within the analysis area boundary. The recognized grazing season in the allotments or areas of use is from April 1, through October 31. Authorized grazing use on federal lands is administered under Section 3 of the Taylor Grazing Act. To facilitate management of licensed livestock and to improve range conditions, a large expenditure of public funds has been made for range improvements in the area. A large acreage of seeding, many miles of fence and numerous stockwater developments have been constructed over the past 30 years. For a complete list of range improvements in the area, see the summary on Illustration 9 and for location of projects see Illustration 8. A description of the grazing allotments and authorized use is as follows:

Whitley Individual Allotment - Consists of approximately 500 acres fenced in on the north, east and south slopes of Vale Butte. One hundred forty acres of this allotment are included in the analysis area. Twelve cows are licensed here for 72 AUM's total use. Twenty of these AUM's are taken within the analysis area. These are the only federal range qualifications Whitley has.

North Harper Community Area of Use - Consists of approximately 29,206 acres of federal land. All but 540 acres of this area is included within the analysis area boundary. Thirteen cattle operators and one sheep operation depend on this acreage for 3,682 AUM's of their livestock use for the season. This is all but 67 AUM's of their authorized grazing use. These are the only federal range qualifications the 13 cattle operators have.

Nyssa Community Area of Use - Approximately 3,280 acres of this use area are located inside the analysis area. Seven cattle operations and one sheep operation are dependent on this acreage for 300 AUM's of their livestock use for the season. The total allotment consists of 71,328 acres of NRL. Total qualifications for the livestock operators in this area of use is 5,113 AUM's.

Freezeout Mountain Community Area of Use - Approximately 320 acres of this use area are located inside the analysis area. Five cattle operations and one sheep operation are dependent on this acreage for 32 AUM's of their livestock use for each season. The total allotment consists of 111,742 acres of NRL. Total qualifications for the livestock operators in this area use are 11,866 AUM's.

Alkali Springs Allotment - Approximately 11,020 acres of this allotment are located inside the analysis area. Thirteen cattle operations are dependent on this acreage for 2,395 AUM's of their livestock use for the season. The total allotment consists of 61,707 acres of NRL. Total qualifications for the livestock operators in this allotment are 13,365 AUM's.

Fenced Federal Range - The remaining Federal acres within the analysis area is presently fenced in with and used in conjunction with private rangeland by 6 different livestock operators. A portion of their qualified use on Federal range is taken on these lands, based on their grazing capacity. This use is small and is of no economic consequence to these operations.

There are no wild horses or burros in the EAR Area.

BIRDS

ORDER	SCIENTIFIC NAME	COMMON NAME
Ciconiiformes	Ardea herodias	Blue Heron
Anseriformes	Olor columbianus	Whistling Swan
	Branta canadensis	Canada Goose
	Branta canadensis leucopareia	Lesser Canada Goose
	Anas platyrhynchos	Common Mallard
	Mareca americana	Baldpate (Widgeon)
	Anas cyanoptera	Cinnamon Teal
Falconiformes	Cathartes aura	Turkey Vulture
	Accipter gentilis	Goshawk
	Accipter strinlus	Sharp-shinned Hawk
	Accipter cooperi	Cooper Hawk
	Buteo jamaicensis	Red-tail
	Buteo swainsoni	Swainson Hawk
	Buteo lagopus	American Rough-legged Hawk
	Buteo regalis	Ferruginous Hawk
	Aquila chrysaetos	Golden Eagle
	Haliaeetus laucocephalus	Bald Eagle
	Circus hudsonius	Marsh Hawk
	Falco mexicanus	Prairie Falcon
	Falco columbarius	Pigeon Hawk
	Falco sparverius	Sparrow Hawk

ORDER	SCIENTIFIC NAME	COMMON NAME
Galliformes	Alectoris graeca	Chukar Partridge
	Lophortyx californica	California Quail
	Phasianus colchicus	Ring-necked Pheasant
Charadriiformes	Charadrius vociferus	Killdeer
	Capella gallinago	Common Snipe
	Numenius americanus	Long-billed Curlew
	Limnodromus griseus	Short-billed Dowitcher
	Ereunetes mauri	Western Sandpiper
	Recurvirostra americana	Avocet
	Himantopus mexicanus	Black-necked Stilt
	Steganopus tricolor	Wilson Phalarope
	Larus californicus	California Gull
	Larus delawarensis	Ring-billed Gull
	Sterna forsteri	Forster Tern
	Hydroprogne caspia	Caspain Tern
Columbiformes	Columba livia	Rock Dove
	Zenaidura macroura	Mourning Dove
Strigiformes	Tyto alba	Barn Owl
	Otus asio	Screech Owl
	Otus flammeolus	Flammulated Owl
	Bubo virginianus	Great Horned Owl
	Glaucidium gnoma	Pygmy Owl
	Speotyto cunicularia	Burrowing Owl
	Strix nebulosa	Great Grey Owl
	Asio otus	Long-eared Owl
	Asio flammeus	Short-eared Owl
	Aegolius acadica	Saw-whet Owl

ORDER	SCIENTIFIC NAME	COMMON NAME
Caprimulgiformes	Phalaenoptilus nuttalli	Nuttall's Poor-will
	Chordeiles minor	Nighthawk
Micropodiformes	Aeronautes saxatalis	White-throated Swift
	Selasphorus platycercus	Broad-tailed Hummingbird
	Selasphorus rufus	Rufous Hummingbird
Coraciformes	Megaceryle alcyon	Belted Kingfisher
Piciformes	Colaptes cafer	Red-shafted Flicker
	Sphyrapicus varius	Yellow-bellied Sapsucker
	Sphyrapicus thyroideus	Williamson Sapsucker
Passeriformes	Tyrannus verticalis	Western Kingbird
	Sayornis saya	Say Phoebe
	Empidonax traillii	Traill Flycatcher
	Empidonax wrightii	Gray Flycatcher
	Empodonax hammondi	Hammond Flycatcher
	Contopus surdilulus	Western Wood Pewee
	Nuttalornis borealis	Olive-sided Flycatcher
	Eremophila alpestris	Horned Lark
	Tachycineta thalassina	Violet-green Swallow
	Riparia riparia	Bank Swallow
	Stelgidopteryx ruficollis	Rough-winged Swallow
	Hirundo rustica	Barn Swallow
	Petrochelidon pyrrhonota	Cliff Swallow
	Pica pica	Magpie
	Corvus corax	Raven

ORDER	SCIENTIFIC NAME	COMMON NAME
Passeriformes	Corvus brachyrhynchos	Common Crow
	Nucifraga columbiana	Clark Nutcracker
	Parus gambeli	Mountain Chickadee
	Sitta carolinensis	White-breasted Nuthatch
	Sitta canadensis	Red-breasted Nuthatch
	Certhia familiaris	Brown Creeper
	Troglodytes aedon	House Wren
	Troglodytes troglodytes	Winter Wren
	Telmatodytes palustris	Long-billed Marsh
	Catherpes mexicanus	Canyon Wren
	Salpinctes obsoletus	Rock Wren
	Oreoscoptes montanus	Sage Thrusher
	Turdus migratorius	Robin
	Ixoreus naevius	Varied Thrush
	Hylocichla fuscescens	Veery Thrush
	Sialia currucoides	Mountain Bluebird
	Regulus satrapa	Golden-crowned Kinglet
	Bombycilla garrula	Bohemian Waxwing
	Bombycilla cedrorum	Cedar Waxwing
	Lanius ludovicianus	Loggerhead Shrike
	Sturnus vulgaiis	Starling
	Vireo solitarius	Solitary Vireo
	Vireo gilvus	Warbling Vireo

ORDER	SCIENTIFIC NAME	COMMON NAME
Passeriformes	Dendroica petechia	Yellow Warbler
	Dendroica auduboni	Audubon Warbler
	Dendroica nigresceus	Black-throated Gray Warbler
	Dendroica townsendi	Townsend Warbler
	Geothlypis trichas	Yellow-throat
	Icteria virens	Wellow-breasted Chat
	Passer domesticus	English (House) Sparrow
	Sturnella neglecta	Western Meadowlark
	Xanthocephalus xanthocephalus	Yellow-headed Blackbird
	Agelaius phoeniceus	Red-winged Blackbird
	Icterus bullocki	Bullock Oriole
	Euphagus cyanocephalus	Brewer Blackbird
	Molothrus ater	Brown-headed Cowbird
	Piranga ludoviciana	Western Tanagers
	Passerina amoena	Lazuli Bunting
	Hesperiphona vespertina	Evening Grosbeak
	Carpodacus mexinanus	House Finch
	Acanthis flammea	Common Redpoll
	Spinus tristis	Gold-finch
	Chlorura chlorura	Green-tailed Towhee
	Pipilo erythophthalmus	Rufous-sided Towhee
	Passerculus sandwichensis	Savannah Sparrow
	Chondestes grammacus	Lark Sparrow
	Amphispiza belli	Sage Sparrow
	Junco hyemalis	Slate-colored Junco
	Junco oreganus	Oregon Junco
	Spizella passerina	Chipping-Sparrow

ORDER	SCIENTIFIC NAME	COMMON NAME
Passeriformes	Spizella breweri	Brewer Sparrow
	Zonotrichia atricapilla	Golden-crowned Sparrow
	Zonotrichia leucophrys	White-crowned Sparrow
	Passerella iliaca	Fox Sparrow
	Melospiza melodia	Song Sparrow
	Calcarius lapponicus	Lapland Longspur
	Plectrophenax nivalis	Eastern Snow Bunting

See Illustration 10 for Use Areas for Common Recreational Wildlife Species.

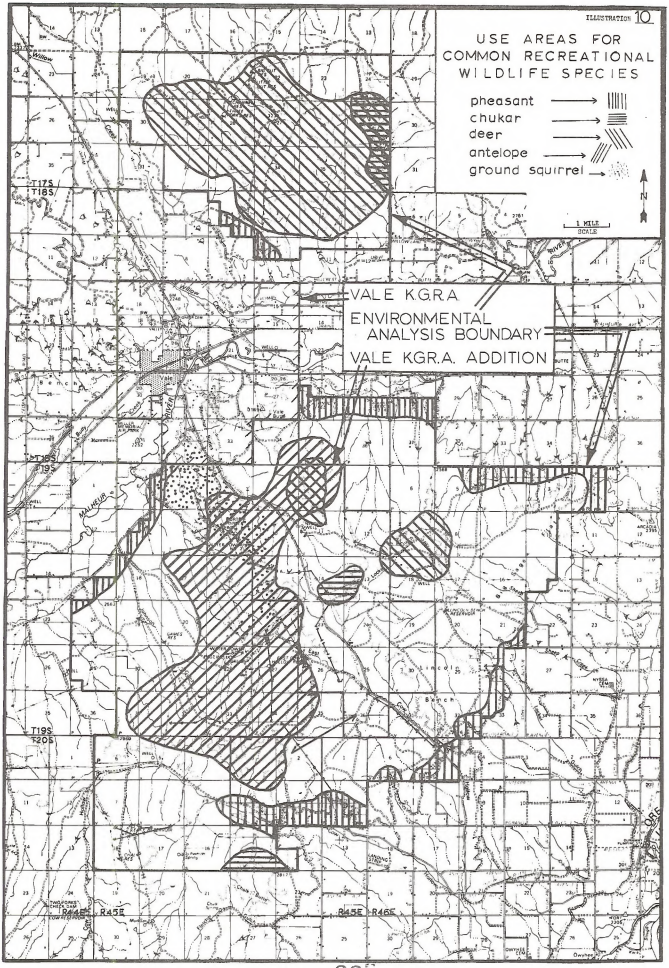


ILLUSTRATION 10
USE AREAS FOR COMMON RECREATIONAL WILDLIFE SPECIES
pheasant
chukar
deer
antelope
ground squirrel
N
1 MILE SCALE
VALE K.G.R.A.
ENVIRONMENTAL ANALYSIS BOUNDARY
VALE KGR.A. ADDITION
T17S T18S
T19S T20S
R44E R45E
R45E R46E
MALHEUR
BULLY CREEK

AMPHIBIANS
&
REPTILES

FAMILY AMBYSTOMIDAE	
Ambystoma macrodactylum columbianum	Northern Long-toed Salamander
FAMILY PELOBATIDAE	
Scaphiopus intermontanus	Great Basin Spadefoot Toad
FAMILY BUFONIDAE	
Bufo boreas boreas	Western Toad; Boreal Toad
Bufo woodhousei woodhousei	Woodhouse's Toad; Rocky Mountain Toad
FAMILY HYLIDAE	
Hyla regilla	Pacific Treefrog
FAMILY RANIDAE	
Rana pretiosa	Spotted Frog
Rana pipiens	Leopard Frog
FAMILY IGUANIDAE	
Crotaphytus collaris bicinctores	Great Basin Collared Lizard
Crotaphytus wizlizenii wizlizenii	Long-nosed Leopard Lizard
Sceloporus occidentalis biseriatus	Great Basin Fence Lizard
Sceloporus graciousus graciousus	Northern Sagebrush Lizard
Uta stansburiana stansburiana	Northern Side-blotched Lizard
Phrynosoma platyrhinos platyrhinos	Northern Desert Horned Lizard
Phrynosoma douglassi douglassi	Short-horned Lizard; Pigmy Horned Lizard

FAMILY SCINCIDAE	
Eumeces skiltonianus skiltonianus	Western Skink
Eumeces skiltonianus utahensis	Great Basin Skink
FAMILY TEIIDAE	
Cnemidophorus tigris tigris	Great Basin Whiptail Lizard
FAMILY COLUBRIDAE	
Coluber constrictor mormon	Western Yellow-bellied Racer
Masticophis taeniatus taeniatus	Desert Striped Whipsnake
Pituophis melanoleucus deserticola	Great Basin Gopher Snake
Thamnophis sirtalis fitchi	Common Garter Snake; Valley Garter Snake
Thamnophis elegans vagrans	Western Terrestrial Garter Snake; Wander Garter Snake
Sonora semiannulata	Western Ground Snake
Hypsiglena torquata deserticola	Desert Night Snake
FAMILY VIPERIDAE	
Crotalus viridis lutosus	Great Basin Rattlesnake

Insects

The significance and status of most of the insects and arthropods in this general area are not known. Certain species which have a high impact upon agriculture are known but these species generally do not occur upon the big sagebrush rangelands typical of the lands within the EAR area.

The following groups of insects and arthropods have been recognized as occurring in varying abundance, on the involved lands.

Spiders

Quite a variety of species which are undoubtedly typical of the Intermountain/Great Basin sagebrush rangelands.

Wood ticks

The genius Dermacentor is seasonally abundant. This animal has been known to transmit Rocky Mountain tick fever to humans.

Aphids

Occasional on sagebrush, bitterbrush, and other species.

Lice

General on mammals and birds of area. Many species are host specific to individual mammalian or avian species.

Red ants

Probably the most obvious insect species present on a permanent basis. Common thoughout area. Capable of painful bites to humans and other mammals.

Stink beetles

Especially abundant in the autumn.

Grasshoppers

Very abundant on a cyclic basis; numerous species.

Deer flies, horse flies, bot flies, house flies, and related species are normally numerous and evident. Face flies and heel flies harass livestock during the summer.

Sagebrush webworm. Aroga websteri

A sagebrush defolient which is cyclic in abundance, locally abundant.

Tent caterpiller

Common on bitterbrush.

Moths (general)

Super abundant night flying species during the hot summer and early autumn months. Great variety of species.

Butterflies

A number of species; many related to individual species of plants.

Lady bugs

Common during the summer, especially near agricultural lands.

Wheatgrass bugs. Irbisia pacifa, other genera.

Occasionally common on crested wheatgrass and bluebunch wheatgrass. Crested wheatgrass seedings on lands adjacent to KGRA.

Alkali bees, Nomia sp.

Common in beds near agricultural lands. A beneficial insect used for pollination of legume seed crops.

Leaf cutter bees. Megachile spp.

A favored species used for the pollination of legumes for seed crops. Leaf cutter bees are raised by many local farmers; wild populations common.

Crickets

Occasional to common.

Mormon cricket

Highly cyclic; generally uncommon here.

Mosquitos

Seasonally abundant due to proximity of Malheur River and irrigated farm lands.

Beet leaf hopper

Utilizes wild mustards in life cycle; carrier of curly top, a destructive virus disease of sugar beets.

There are no known rare and endangered species of plants or wildlife inhabiting the area. See Appendix V, letter from Mrs. A. C. Siddall of the Oregon Chapter of the Nature Conservancy. The proposed rare species she indicated are presently being checked out with the curator of the herbarium at Oregon State University.

C. Ecological Interrelationships

Ecological interrelationships deal with interworkings between and among all living and non-living components of an eco-system. The term eco-system is used when referring to habitat and community as an interacting unit. The functions of an eco-system are dependent upon the primary producers that convert solar energy to chemical energy. Plants generally are the primary producers which convert solar energy, moisture, and the basic elements into organic energy. The consumers - cattle, deer, etc., use the plants and they, in turn, are utilized by man and predators - coyotes, bobcats, etc. The decomposers are primarily bacteria and other organisms that break down material which is recycled through the system.

The eco-system approach attempts to consider the plant and animal communities and populations as a whole in relation to one another and to their total environment. The major component sub-systems are the hydrologic cycle, energy flow, and the nutrient cycle.

Hydrologic Cycle

The hydrologic cycle is depicted in Illustration 11. The sun supplies the heat energy and this, together with the force of gravity, keeps the water moving from the earth to the atmosphere as evaporation and transpiration, and from the atmosphere to the earth as condensation and precipitation. Stream flow and ground water movement complete the cycle. While there is no identifiable point of beginning or end, the oceans generally are considered to be the major source, the atmosphere as the transportation vehicle and the land as the user. Within the total system there is no water lost or gained, but the amount available for use may fluctuate widely seasonally and geographically with supplies ranging from too much to too little. Water quality impacts resulting from man's use of lands, natural resources, and water supplies complicate problems of maintaining balance with man's needs within the capabilities and limitations of this natural system.

Of the many factors which contribute to the physical environment of an eco-system, the movement of water into, through, and eventually out of the system is a major stimulus in the functioning of the system. This cycling of water in the eco-system essentially consists of precipitation inputs, run-off outputs, and a series of intermediate processes influencing the magnitude of the precipitation/run-off relationship. These include interception, infiltration, percolation, evapotranspiration, surface run-off and storage at various levels of the system. The hydrologic cycle may be combined into a conceptual model of watershed behavior as shown in Illustration 12.

The eco-system in which the EAR Area is included (Cold Desert Eco-system) is characterized by low precipitation input with considerable variation from year to year. Evapotranspiration is great. The net result is little soil moisture is available when the weather is warm enough for the plants to use the moisture effectively. This reduces the potential for production of the living components in the Cold Desert Eco-system.

Energy Flow

Energy flows through the eco-system, it does not cycle. The components of the energy flow consist generally of abiotic inputs, producers, consumers, and decomposers as shown in Illustration 13. For example, grasses (producers) capture energy from the sun by photosynthesis and utilize soil nutrients, water, etc. to produce vegetation. Herbivorous and carnivorous animals (consumers) feed on plants and other animals to acquire energy. Bacteria, fungi, and some kinds of animals (decomposers) derive energy in the process of decomposition of dead organisms. Energy is continuously being utilized (used by each group of organisms or lost) and new energy is being acquired from solar radiation.

In the Cold Desert Eco-system solar radiation is high but due to other climatic factors such as limited precipitation and sparce vegetative cover, little solar energy is captured by the plants and used. Therefore, the production capacity of the desert is greatly reduced and the food chain shortened.

Nutrient Cycle

Certain chemicals such as nitrogen, oxygen, phosphorous, and potassium are essential elements to sustain life on the planet earth. These nutrients, as well as others, continuously circulate through the environment following fixed patterns or cycles and in the process are made available in various forms to man and animals (consumers). For example, nitrogen is recycled from plants (producers) to the atmosphere and back in a complicated process whereby organic material is converted into inorganic ammonia, nitrites, and nitrate by successive armies of micro-organisms (decomposers). The nitrate, if not looped back through plants or stored in the soil, is denitrified, and the nitrogen is returned to the atmosphere as gas where it again is available to nitrogen fixing plants, thus, completing the cycle.

The nutrient cycle occurs slowly in the Cold Desert Eco-system as large quantities of nutrients are tied up in shrubby plants that have a slow rate of decomposition.

It is questionable whether the nutrient cycle is in balance on the lands within the boundaries of the EAR. Livestock grazing intensities vary on these lands from moderate to heavy. Steep topography and lack of water limit grazing somewhat.

Livestock grazing accounts for a significant amount of the nutrients being removed from the area. Rodents also harvest a significant amount of vegetation. Rodents, in turn, are preyed upon by coyotes and raptors.

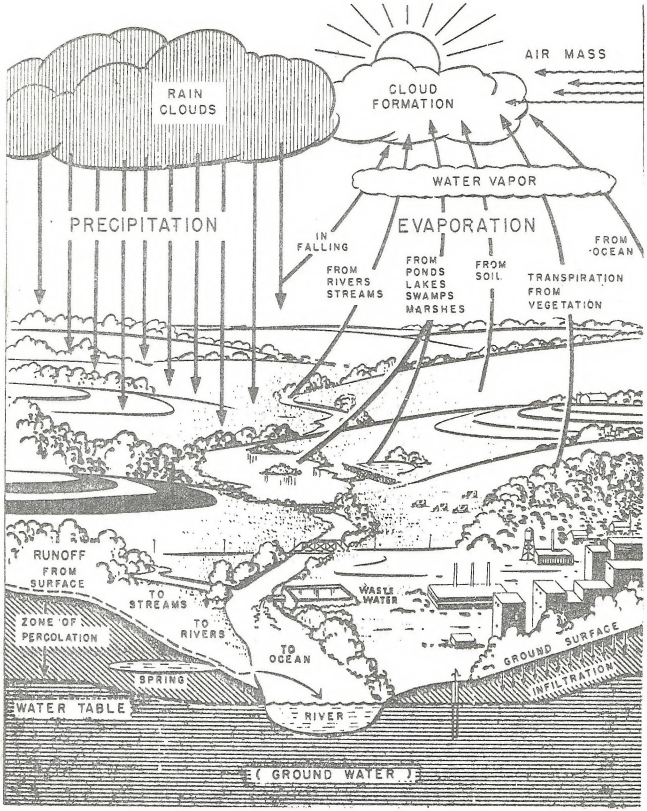
Coyotes are trapped in winter, primarily for their pelts. High fur prices has intensified this effort. They are also hunted for sport.

The predators do not remain within the boundaries of the KGRA. The amount of nutrient loss resulting from rodent predation and the subsequent loss of predators is unknown. It is estimated that this loss is insignificant.

Succession

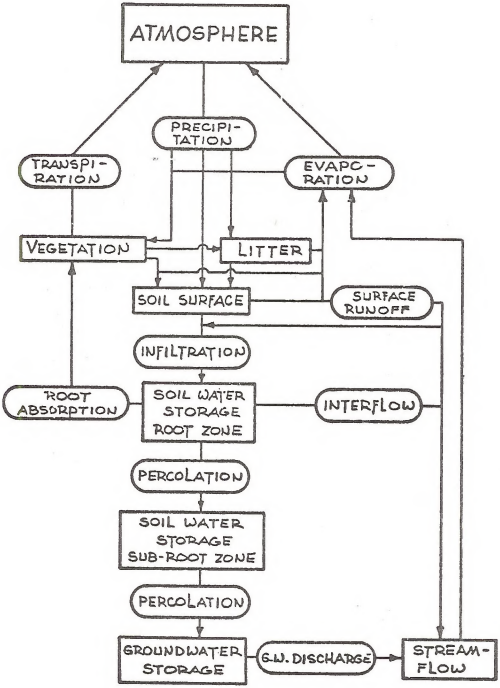
The stage of plant succession of the area has regressed considerably from where it was before the advent of white man in the area. Through historical uncontrolled grazing, the perennial grasses favored by cattle have been eliminated and less desirable grasses and brush have replaced them. Much of the site is capable of producing a much denser stand of perennial grass and forbs; however, the natural upward succession is slow due to low rainfall, immature soils, and harvesting activities carried on by the rodents and livestock.

In an attempt to improve range and watershed conditions, areas with deeper, more mature soils have been revegetated through seeding of crested wheatgrass (Agropyron cristatum) an introduced perennial grass. This has created a patchwork of artificially induced seral communities. In areas that supported an understory of native perennial grasses, sagebrush was sprayed with defolitants to reduce brush-grass competition. This treatment has at least temporarily changed the brush-grass composition of these communities and speeded the increase of perennial grass cover in the treated areas. A complete list of seedings and brush eradication jobs can be found on Illustration 9. Locations of these land treatment areas are shown on Illustration 8.


AIR MASS
RAIN CLOUDS
CLOUD FORMATION
WATER VAPOR
PRECIPITATION
EVAPORATION
IN FALLING
FROM RIVERS STREAMS
FROM PONDS LAKES SWAMPS MARSHES
FROM SOIL
FROM OCEAN
TRANSPIRATION FROM VEGETATION
RUNOFF FROM SURFACE
TO STREAMS
TO RIVERS
TO OCEAN
WASTE WATER
ZONE OF PERCOLATION
SPRING
WATER TABLE
RIVER
GROUND SURFACE INFILTRATION
(GROUND WATER)

Flow Diagram of the Grassland Hydrologic Cycle

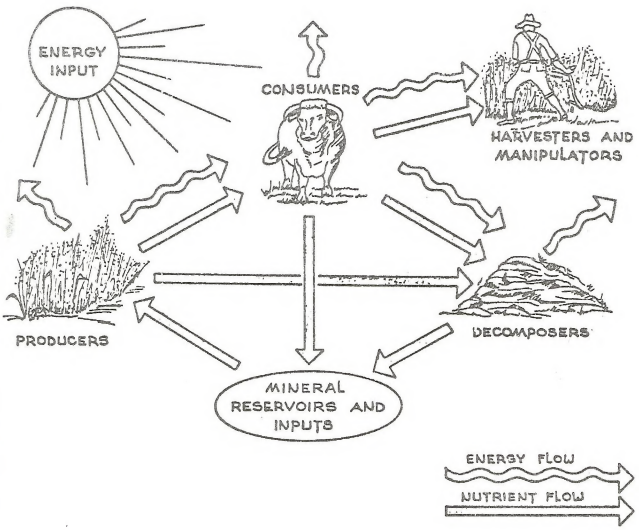
Illustration 12



Source: Striffler, W.D. 1969. "The Grassland Hydrologic Cycle," p. 103, in R.L.Dix and R.G.Beidleman (ed.), "The Grassland Ecosystem: A Preliminary Synthesis." Range Science Department, Science Series No. 2. Colorado State University, Fort Collins, Colorado.

A schematic Illustration of Pathways of Flow of
Energy and Matter Through a Terrestrial Ecosystem

Illustration 13



Source: Van Dyne, G.M. 1969. "Some Mathematical Models of Grassland Ecosystems," P. 6, in R.L.Dix and R.G.Beidleman (ed.), "The Grassland Ecosystem: A Preliminary synthesis." Range Science Department, Science Series No. 2, Colorado State University, Fort Collins, Colorado.

D. Human Values:

There are no human inhabitants on the federal land or the private land on which the mineral estate belongs to the Federal Government within the EAR Area. Human influence is very evident on the area, however. The city of Vale is within five minutes driving time of the area and portions of the area can be seen from the city. There is a significant amount of recreation time spent on this land - varmit shooting, snowmobiling, and a limited amount of hunting. There is intensive off road vehicle use in the hills south of Vale and a cross country motorcycle race course in the hills north of Vale.

The entire county, but specifically the area between Vale, Nyssa, and Ontario, will be affected by geothermal development in the EAR Area. The sub-topics of educational and scientific values, cultural values, social welfare, attitudes and expectations, and local and regulatory structures have, therefore, been broadened to include the entire tri-city area and in some cases the entire county.

Educational and Scientific Values:

Approximately nine miles of the historic Oregon Trail parallels present day Lytle Boulevard which passes through the center of the KGRA Addition. Remnants of trail ruts are still visible along portions of the boulevard. These nine miles of the Oregon Trail qualify for inclusion in the National Register of Historic Places. An Oregon Trail Wayside Exhibit will be constructed near the summit of the pass (within the KGRA Addition) south of Vale comprising approximately ten acres. See Illustration 14 for the location of the Oregon Trail within the EAR Area.

For a discussion of archeological values within the boundaries of the EAR, see Appendix XI.

CULTURAL VALUES

Historical Background

Malheur County, now recognized as one of Oregon's leading agricultural counties, was first settled by miners and stockmen in the early 1860's. Gold was first discovered in Mormon Basin in the northwestern part of the county in the spring of 1863. Soon after, the first two large stock ranches were established in Jordan Valley in the southern part of the county.

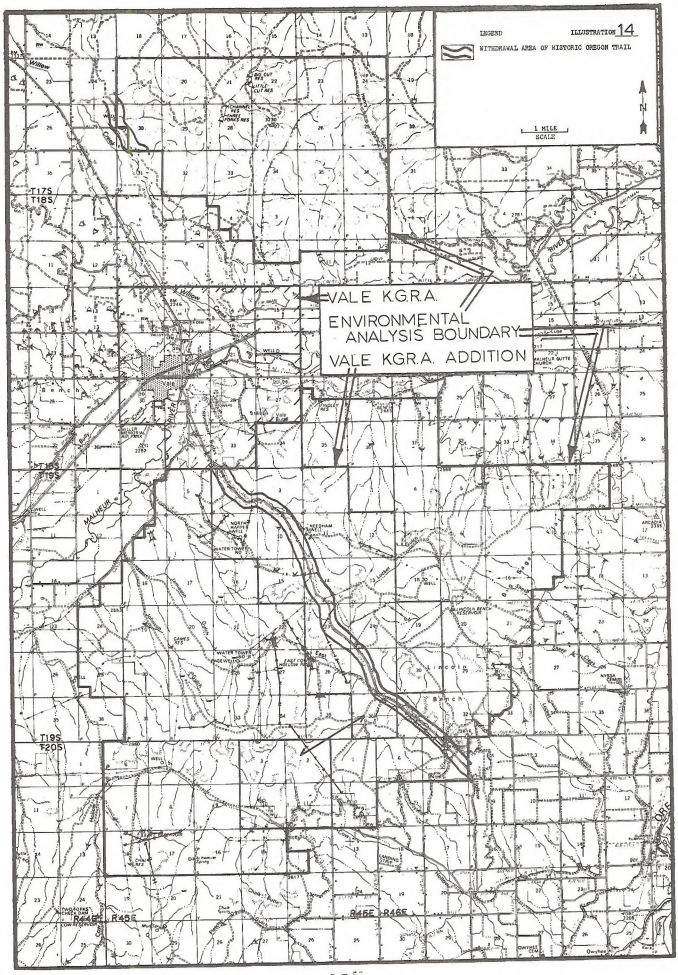
In the fall of 1863, Jonathan Keeney built a small log house at the Malheur River ford of the Oregon Trail just south of the present site of Vale. In this cabin Keeney conducted a wayside inn for the accommodation of emigrants, miners and freighters. The historic old emigrant road, forming a link in the line of travel to the Willamette Valley in western Oregon. In 1870, L. B. Rinehart purchased the Keeney station and in 1872 built a stone house. This old landmark, known as the "old stone house", is still standing.

The Malheur River, Willow and Bully Creek Valleys, all tributary to Vale, became well settled and the town grew to be an important trading center. The impetus given the town by its selection as the temporary County Seat in 1887 was considerable and many new business enterprises were added. The selection of Vale as the permanent County Seat by the general elections of 1888 and 1890 strengthened the local economy and insured the permanency of the town. By 1900, Vale had a population of 200.

Until 1900, Malheur County possessed an excellent stock range of immense proportions. With increasing population and settlement of the county the range gradually failed to support the stock grazing upon it and stock raising declined. The farming industry began growing in importance in the early 1880's, in Malheur County.

In 1883, two important irrigating canals were built; the Owyhee canal, which distributed water from the Owyhee River in the immediate valley, and the Nevada canal, which distributed water from the Malheur River in the lower Malheur Valley. These two canals had a significant impact on the community, contributing to make farming a profitable industry long after the stock industry passed onto minor importance.

The Oregon Short Line Railroad was also a major influence in the development of Malheur County in the 1880's. A station was established at Ontario in 1884, which rapidly became an important shipping point as a result. It was more accessible from the stock ranges of Malheur, Grant and Harney Counties. The establishment of this trade center made the development of agriculture and other resources not only possible, but highly profitable.


LEGEND
ILLUSTRATION 14
WITHDRAWAL AREA OF HISTORIC OREGON TRAIL
1 MILE
SCALE
N
VALE KGRA.
ENVIRONMENTAL
ANALYSIS BOUNDARY
VALE KGRA. ADDITION
T17S
T18S
T19S
T20S
R44E
R45E
R46E
R47E
R48E
Malheur
Owyhee

Social Background

Malheur County is undergoing a population shift from rural to urban living. Ontario has shown a large increase in population, while the county as a whole has not. There has been considerable out-migration from the county, especially in the 24-44 year old age group. There is also an annual influx of several thousand migrant farm laborers during the summer harvest season.

The population of Malheur is predominantly Caucasian, about 85 percent. Nearly 10 percent of the people in Malheur County are Spanish-surnamed, primarily Mexican Americans. Japanese Americans comprise close to 4 percent of the counties' population. Included in the population count for Caucasians, is another ethnic group which has maintained its own separate identity within the local community, the Basques.

The Basques first came to eastern Oregon in the 1890's, settling in the area between Ontario and the Steens Mountains, on southward, where raising sheep was the main industry. Many were eventually able to acquire land and herds of their own. A large number of Basque ranches were established along Jordan Creek in the southern part of Malheur County.

The Basque way of life is rapidly becoming extinct. Many young Basques do not speak the Basque language. Their life-style and values are more Americanized. Members of the younger generation no longer restrict themselves to the agricultural pursuits of their parents, or limit social contacts to the Basque community. (Kressman, L. E. and Yturri, Anthony, 1938).

There are a little over 900 Japanese American people now living in Malheur County. Prior to 1940 there had only been 20 to 30 families, but during World War II close to 4,000 Japanese people were evacuated from the coast to relocation camps in the county. In 1946, when they were allowed to return to the coast, the number dropped to approximately 2,000. (Iseri, George, March 6, 1974, Personal Interview).

Approximately 75 percent of the Japanese Americans in Malheur County work in agriculture, and most of these own their own land. Many Japanese Americans in recent years have joined inter-ethnic rather than ethnic cooperatives, and are taking prominent roles in the affairs of local communities. One part of the Japanese culture very actively maintained is the Ontario Buddhist Church. With a congregation of about 900 people, it draws its membership from a large radius in Oregon and Idaho. (Iseri, George, March 6, 1974, Personal Interview).

The population of Mexican American people in Malheur County fluctuates with the seasonal demands for farm labor. However, there are over 2,500 permanent residents living in the county year-round. The large percentage are United States citizens, approximately 30 percent being citizens of Mexico with permanent resident visas. Many Mexican Americans in the county speak little or no English. They continue to live in a culturally segregated environment where the Spanish language is the main form of communication.

There has been no community program established to promote general acceptance of the Mexican American people. There is no program to promote continued education for a large majority who are illiterate or have knowledge of English. Children are often kept out of school part of each year to work in the fields. There is no enforcement of school attendance laws nor a direct interest on the part of the schools to determine and certify registration of the school age children.

References

"Basques in Oregon", Kressman, L. E. and Yturri, Anthony. Commonwealth Review. March, 1938.

Indicators of Depressed Economic Conditions. Grant Morgan Association. Portland, Oregon. 1972.

Kitano, Harry H., Japanese American, The Evolution of a Sub Culture. Prentis Hall, Inc., Englewood Cliff, N. J. 1969.

Summary Manpower Indicator for Oregon, 1970 Census. U. S. Department of Labor, Manpower Administration. Data Systems & Report, Region 9 in cooperation with the Office of Planning, Evaluation & Research. William B. Hewitt, Director.

Larry Silveira, Manager (Telephone Communication)
Nyssa Human Resource Center Phone: 372-3831
P. O. Box 765
Nyssa, Oregon 97913

Iseri, George, March 6, 1974, Personal Interview.

SOCIAL WELFARE

Social and Economic Situation

Malheur County has a population of 24,100 people, 75 percent of whom live within a 25 mile radius of the KGRA Addition, and will be directly effected by the development. Most of the population is concentrated along the Snake River, Malheur and Lower Owyhee River valleys. The main towns of Ontario, Nyssa and Vale are in the agriculture area. In 1974 the population of Ontario was 7,700. In Nyssa it was 2,735 and in Vale, it was 1,705. Nearly 40 percent of the people live in or near Ontario, about 16 miles from the KGRA Addition. Vale is the closest town to the KGRA Addition.

The County economy is largely dependent on agriculture, livestock production being the highest single contributor to the economy. Other agriculture products are dairying, sugar beets, potatoes, onions and corn. The food processing plants at Ontario and Nyssa are dependent on the local agriculture. Ontario is the major trade center for Malheur County.

According to the 1970 census Malheur County was the third poorest county in the state. It is now estimated to be the second poorest county. Nearly 4,600 people are living at or below the poverty level. That is about 20 percent of the total population of Malheur County. The following table indicates the annual income at which the poverty level is determined:

For Family Of:	Non-Farm Residents	Farm Residents
1	$2,000	$1,700
2	$2,600	$2,100
3	$3,300	$2,800
4	$4,000	$3,400
5	$4,700	$4,000
6	$5,300	$4,500
7	$5,900	$5,000
over 7	add $600 for each person	add $500 for each person

Most of the housing in the area around the KGRA Addition is owner occupied. Rentals in Ontario, Nyssa and Vale are very scarce. The area is served by two hospitals, the County Hospital at Nyssa and Holy Rosary Hospital in Ontario. One doctor and a dentist serve Vale. Four

doctors and two dentists serve Nyssa. Nine dentists and 13 physicians serve Ontario.

References

Indicators of Depressed Economic Conditions. Grant Morgan Association. Portland, Oregon. 1972.

Summary Manpower Indicator for Oregon, 1970 Census. U. S. Department of Labor, Manpower Administration. Data Systems & Report, Region 9 in cooperation with the Office of Planning, Evaluation and Research. William B. Hewitt, Director.

ATTITUDES AND EXPECTATIONS

Due to shortages of manpower and funds, it was not possible to conduct a comprehensive survey of attitudes and expectations held by the general public. In order to get some concept of public opinion, interviews were conducted with several local businessmen, news media personnel and government officials in the Treasure Valley area. The following is based on information gathered in these interviews.

Vale - Attitudes in Vale were described as basically supportive of the status quo. People interviewed felt that in the past, conservative attitudes have discouraged and impeded commercial and industrial development in Vale. The rate of development is increasing, with local support, but continues to be limited.

According to the people interviewed, Vale citizens support strong local government and local control of economic development. They are concerned about the effects that rapid growth in population and/or development might have on the quality of life in their community. Those interviewed felt that most people living in Vale enjoy the rural style of life and wish to maintain it in their community.

The people interviewed felt that Vale would support an approximate growth rate of 5 percent, which would mean a growth in population of about 100 people. They also felt that the people of Vale would oppose heavy industry that was noisy or polluting, and would prefer small industry, varying in size from 20-30 to 50-100 employees.

Those interviewed reported that Vale supported the construction of Treasure Valley Community College, as well as the development of the West Park Plaza shopping center, although local business people were initially opposed to the shopping center. Both the college and shopping center are located in Ontario.

Nyssa - According to the people interviewed in Nyssa, public attitude there has supported planned development, a steady consistent growth pattern at a moderate rate. The development of an industrial park has promoted the growth of light and agriculture related industry in Nyssa. The people interviewed felt that industries such as Albertson Feed Yard and the Amalgamated Sugar Company have brought stability to the whole irrigated valley area. Migrant workers are also seeking jobs in these industries more and more as the demand for farm labor decreases due to expanding farm automation.

People in Nyssa have not supported the Treasure Valley Community College, in the opinion of those interviewed, because of the increased taxes involved. Voters in Nyssa have consistently defeated TVCC budgets and nearly defeat local school budgets. The general public

did support the construction of the West Park Plaza shopping center, although local business people had some reservations about it at first.

According to those interviewed, the people of Nyssa want clean, non-polluting, light industry, preferably related to agriculture. However, some respondents indicated that Nyssa may be forced to attract other types of industry to promote growth and that some people in Nyssa would support a free, open door policy to all new development. In addition, Nyssa is working together with Ontario to explore the possibilities of establishing a dry land port authority which would encompass the entire irrigated agricultural area, greatly enhancing industrial-commercial development.

The people interviewed felt that Nyssa would benefit the most from the growth of small industries in the range of 50 to 150 employees, stating that the people of Nyssa are very concerned about the stability of their local economy and would oppose any industry large enough to dominate the whole economic structure of the community.

Ontario - The people interviewed in Ontario felt that public attitudes there had undergone a change in recent times. They indicated that in the past Ontario had had an erratic growth rate, some areas of development not keeping pace with others, an effective pressure group often being the determining factor. Those interviewed expressed the opinion that public attitudes in Ontario now supported more balanced development with diversification in industrial, commercial and residential growth.

According to the individuals interviewed, the people of Ontario were divided over the issue of building Treasure Valley Community College, mainly because of the taxes involved. However, support for the college has grown since its completion. The people interviewed also indicated the development of West Park Plaza shopping center received the support of the general public, in spite of some initial opposition from downtown business people. The shopping center has brought in considerably more trade to the downtown business district which has off-set loss of some business to the shopping center. With the addition of West Park Plaza, Ontario draws from a trade area in Oregon and Idaho with a population of over 50,000 people.

Whereas in the past Ontario has encouraged any size and type of industrial development, according to those interviewed, public attitudes have shifted in favor of clean, non-polluting industries, particularly those related to agriculture. They also prefer labor intensive industries that create more jobs for local people rather than bringing in outside employees.

The people interviewed felt that Ontario has a great potential for industrial development, which may be expanded even more through the possible development of a dry land port authority in cooperation with Nyssa, as mentioned previously.

PUBLIC ATTITUDES AND EXPECTATIONS TOWARD BLM MANAGEMENT AND ACTIVITIES

According to the people interviewed, public attitudes and expectations of BLM management and activities are very positive. The people of Vale like having the BLM office in town which they see as a business that does not take resources out of the community but adds to the community. All of the people interviewed in Vale, Nyssa and Ontario supported BLM in its multiple use concept. The general public, with some exceptions, supports BLM management policies.

This has been a change from public attitudes previous to the Vale Project in the early 1960's. At that time, public attitudes towards BLM were very negative. The success of the Vale Project has apparently had a significant positive effect on public opinion.

Those interviewed indicated that people throughout the valley enjoy the use of open space in Malheur County, and value its availability for public use. People like open space to carry on their recreation activities and support county, city and federal government programs which provide for open space. Quality of open space is more important than quantity of open space.

PUBLIC ATTITUDES AND EXPECTATIONS OF PROPOSED GEOTHERMAL DEVELOPMENT

From the information gathered in interviews, both local governments and the general public in Vale, Ontario and Nyssa, are very supportive of geothermal development. People believe that directly or indirectly their communities will benefit from the development. There have been no objections made known to BLM from local citizens with the exception of one letter from an individual in Ontario who had discussed the issue with a BLM employee. It is felt, however, that the general public is not technically knowledgeable on this issue and not fully aware of the problems associated with geothermal steam. However, the slow pace of geothermal development on both private and federal lands in relation to public expectations has led to a very low level of interest at the present time. Local people tend to compare geothermal development to their experiences with oil and gas development in the area. In this instance, there has been drilling and some shows of oil and gas since the early 1900's but nothing economic to date. People expect geothermal development to follow the same pattern.

LOCAL REGULATORY STRUCTURES

A. Land Use Planning

The following information was gleaned from interviews with people in City and County Government Agencies in Vale, Nyssa and Ontario.

1. Acceptability of Planning Within the Local Population

a. City Planning:

The cities of Nyssa, Vale and Ontario all have city planning commissions. In general, the people of these cities accept and support land use planning. The cities recognize there has to be some type of zoning and planning to have an orderly growth. However, vested interest groups, still oppose it.

According to the people interviewed, the cities of Nyssa and Vale appear at the present, to have enough land use planning to carry them through. The people of Nyssa are very interested in land use planning. The planning commission is becoming more active and responsive to land use planning. In the past land use planning and zoning ordinances lacked enforcement; therefore, they were not followed like they should have been. This encouraged a minimum effort to be put forth toward any future land use planning. The City of Ontario has had a tendency to look at land use planning as a necessary nuisance but a favorable balance is beginning to emerge in the community.

b. County Planning:

Land use planning in Malheur County is less than two years old. In general, people of Malheur County were skeptical of land use planning. They were afraid the designation assigned to their land would be different from what they wanted to use the land for. A minority of people in the county do not see the need for land use planning and resent outside people coming into the area to tell them what the land can be used for.

The county government tends to look upon land use planning as a nusiance. The Oregon Legislature forced all counties within the state to develop land use plans. Malheur County was one of several counties in the state in which a deadline was set to develop land use plans or the state would do the planning for them. People in general are for county planning providing it is not too restrictive. The people are recognizing it is necessary and are accepting it.

2. Present Comprehensive Land Use Plans, Zoning Ordinances, Geothermal Ordinances and Building Codes

a. Comprehensive Land Use Plans (Appendix VIII)

Malheur County Court adopted the Comprehensive Land Use Plan for Malheur County on December 12, 1972, (Commissioner Journal, Book R, p. 479). However, the Comprehensive Land Use Plan was not actually accepted until August 15, 1973, because of an oversight in the recording of the minutes of December 12, 1972, Court's action. The Comprehensive Land Use Plan has been reviewed and accepted by the State of Oregon but is subject to further review and modification by the State to meet State of Oregon objectives. The County was forced to take action or the State of Oregon would step in and do the Comprehensive Land Use Plan for them.

b. Zoning Ordinances

On approximately June of 1973, Malheur County did develop a County Zoning Ordinance. The Malheur County Court adopted the zoning ordinance and it was filed on record August 17, 1973, in the public records (Micro film Inst. 148901). The zoning ordinance still has to be reviewed and accepted by the State of Oregon.

The private lands involved within the EAR area fall under the following zones of the County Zoning Ordinance: Exclusive Farm Use (F-1), and General Farm Use (F-2). The private lands adjoining the National Resource Lands are zoned for Exclusive Farm Use (F-1), and General Farm Use (F-2) on the zoning maps that accompany the proposed ordinance. See Illustration 15 for zoning map and Appendix IX for zoning ordinance.

Under Exclusive Farm Use (F-1), and General Farm Use (F-2), conditional uses are permitted for mineral exploration, mining and processing. The conditional use reads as follows: "Operations conducted for exploration, mining and processing of geothermal resources as defined by subsections (4) of ORS 522-010, aggregate and other mineral resources as other subsurface resources" (See page 9 of Malheur County Zoning Ordinance). Therefore, geothermal exploration and development is permitted under conditional uses with the approval of the Malheur County Planning Commission. According to the Malheur County Planners and District Attorney any company wishing to conduct geothermal or mining exploration and development on private lands must submit their plans to the Malheur Planning Commission for approval.

c. Geothermal Ordinances

On approximately April of 1973, Malheur County pioneered and developed Oregon's first county preliminary geothermal ordinance.

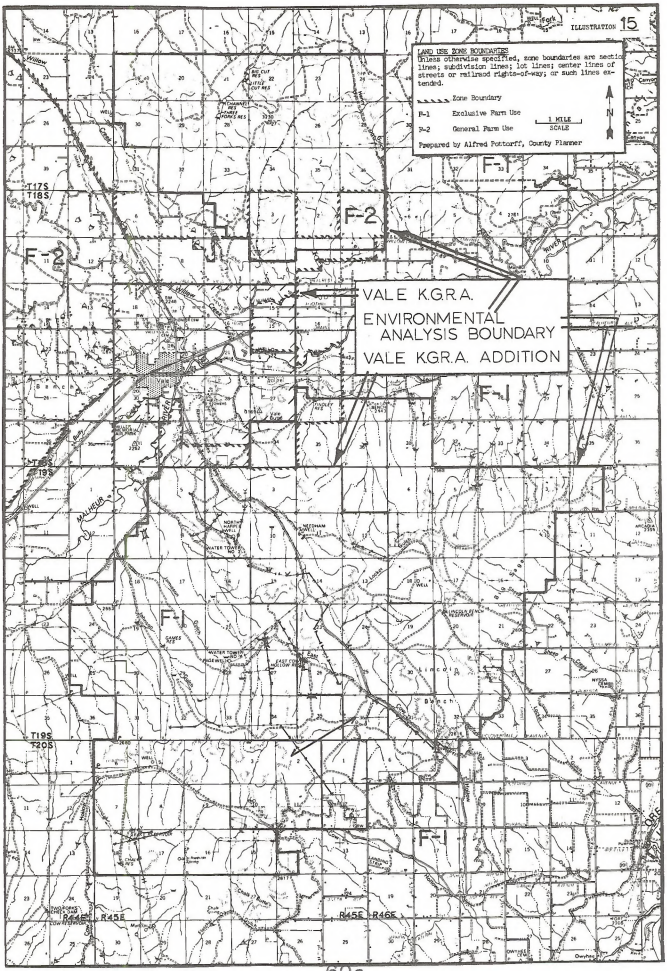


ILLUSTRATION 15
LAND USE ZONE BOUNDARIES
Unless otherwise specified, zone boundaries are section lines; subdivision lines; lot lines; center lines of streets or railroad rights-of-way; or such lines extended.
Zone Boundary
F-1 Exclusive Farm Use
F-2 General Farm Use
1 MILE SCALE
N
Prepared by Alfred Pottorff, County Planner
VALE K.G.R.A.
ENVIRONMENTAL ANALYSIS BOUNDARY
VALE K.G.R.A. ADDITION
F-1
F-2
T17S
T18S
T19S
T20S
R45E
R46E

On June 19, 1974, Malheur County Court adopted the Geothermal Ordinance and it was filed on record June 30, 1974, in the public records (Micro film Inst. No. 158761 - See Appendix X). The ordinance provides for issuance of permits, collection of fees, and provides penalties for violation.

d. Building Codes

The State of Oregon Legislature passed and adopted a uniform building code act (Senate Bill 73-Chapter 834, Oregon Law 1973) which became effective on January 1, 1974. The Act stated that all cities and counties within the State of Oregon must conform to the State building code by July 1, 1974. The Act requires all counties and cities to use a building permit system. Permits will be acquired from the county and city governments. Either the state or county, both will furnish inspectors.

The State Uniform Building Codes referred to are as follows: State of Oregon Structural, Mechanical, Electrical, Plumbing Speciality Codes and Fire and Life Safety Code, 1973 Edition as amended, Uniform Building Code - effective on July 1, 1974.

B. Type Adequacy, Structure and Enforcement of Local Governmental Entities

There are two different schools of opinion relative to the type and adequacy of planning staff, type of governmental structure, and enforcement by local governmental entities regarding the making of land use plans and planning decisions, implementing plans, and the willingness and capability to enforce the land use plans and zoning ordinances: There are those who hold to the traditional type of county and city government and believe the present governmental bodies are performing adequately and see no need for a change. On the other hand, there are those who feel a change is needed in the present local governmental structure because certain segments of the people of Malheur County are not represented and/or the local government could perform more efficiently and effectively with a different type of government structure.

An analysis of local governmental entities are as follows:

1. County Government

The majority of the people interviewed indicated the people desire a change in the type of county government. These changes vary from "Home Rule" type of county government, to the addition of several county commissioners (perhaps a total of 5 to 7), to the present existing county government structure. They indicated people feel they are not being properly represented and the county government structure does not produce but tends to be involved in today's crisis and only gets by with a minimum amount of effort. Because of the growing complexity of county government, people feel it should be managed more professionally.

However, there is a minority of people who feel no change is necessary in the present county government structure.

As for making land use plans and planning decisions, the interviews indicated people feel the county is slow in reacting and implementing the plans and the personnel who are involved in the making of planning decisions should be more knowledgeable or take time to be more knowledgeable. They indicated other people feel the county needs a group of people to keep the county personnel, who are making decisions, informed of alternative choices and decisions. While other people feel land use planning is still too new, the county personnel have not obtained a feel for it, and additional time will be required to get the planning worked out and implemented. After the county personnel get their feet on the ground, they will do an adequate job.

The interviews indicated a majority of people feel the county does not have an adequate planning staff, and the land use planning and implementation is deficient. Others felt that the positions are available but the county does not offer enough money to hire good qualified personnel. A minority group felt the county has an adequate staff to implement planning but planning is still too new and it will take time to get it worked out.

According to the Malheur County Planner, Land Use Planning is new in the county and the county is in the process of implementing and enforcing the land use plans and ordinances. He recognizes the planning staff is presently inadequate in manpower and funds to meet the demand of implementation and enforcement. He indicated that to have an adequate staff, the county needs one planner, one assistant planner, and two inspectors. Presently, there is only one planner who is in charge of planning, drafting and inspection.

The interviews indicated the majority of people feel the county is willing and capable of enforcement of land use plans and zoning ordinances but, because of limited manpower and funds, the enforcement is weak. They feel the county has the information available but tends not to follow through on enforcement, or, only makes a token effort. Others feel the county is willing and capable of enforcing land use plans and zoning ordinances but fail to disqualify themselves in conflict of interest decisions. A minority group feel the county is doing an adequate job of enforcing the county land use plans and zoning ordinances.

As mentioned, the Malheur County Planner recognizes the enforcement of land use plans and the zoning ordinance is inadequate because of the lack of available manpower and funds.

2. City Governments

a. Vale

Vale has a mayor and a city coordinator type of city government. It is similar to city manager type of government, except the city coordinator is personally involved in several different jobs, such as, recorder-city clerk and municipal judge. There are various opinions whether the city of Vale has the right type of governmental structure to make planning decisions. The people interviewed stated a majority of people feel it is not working adequately because adequate zoning ordinances have not been developed and/or perhaps followed, and not properly enforced. A minority group of people feel the present situation is working adequately, and they do not see a need for a change. Those who feel the structure could be improved say positions are available within the city governmental structure but inadequate salaries are offered to hire good qualified personnel. Some of the planning services are contracted out and the Southeast Council of Government is relied upon for assistance on occasions.

The interviews indicated that many people feel the city of Vale has the willingness and capability to enforce existing city ordinances but the enforcement tends to be weak in some areas. Zoning ordinances sometimes are not properly enforced because city officials fail to disquality or separate themselves in conflict of interest decisions and issues.

b. Nyssa

Nyssa has a mayor and city manager type of government. There are various opinions as to whether the city of Nyssa has the right type of governmental structure to make planning decisions. The interviews stated some people feel that under the present situation, the city does not have an adequate type of government structure because the staff and goals need to be changed. However, there are others who feel the present government structure is adequate.

The city of Nyssa presently has a very limited staff to plan, implement plans, and enforce plans in a proper manner, according to the Nyssa City Manager. He indicated the city could not handle land use planning on a large scale basis. The city of Nyssa has the capability to enforce the land use plans and ordinances but no leadership was expressed to carry out

the enforcement. According to Nyssa City Manager, he would like to see the city upgrade their zoning ordinances and land use plans and establish some long range goals.

He indicated that in the past, zoning ordinances and land use plans lacked enforcement. Therefore, the local use plans and ordinances were not followed like they should have been. The city was getting by with a minimum of effort.

c. Ontario

Ontario has a mayor and city manager type of government.

All the people interviewed felt the City of Ontario has the right type of governmental structure to make planning decisions. According to the Ontario City Manager, the City of Ontario has an adequate staff to plan, implement plans, and enforce plans in a proper manner. However, there are those who feel perhaps the city may be slow in preparing and implementing plans.

The City of Ontario has the capability to enforce the land use plans and ordinances. According to the Ontario City Manager, land use plans and ordinances are very strongly enforced. He also stated there have been very few requests for rezoning in Ontario.

C. Need for Additional Ordinances and Land Use Planning

The majority of the people interviewed felt the county and city of Vale should definitely develop ordinances for geothermal exploration and development, or at least develop an ordinance on a limited scale to get a feel for the problems. However, a minority felt no ordinances should be developed.

Those people who are knowledgeable and involved in land use planning and development of ordinances felt very definite about developing geothermal ordinances while those who were not knowledgeable were opposed to any more ordinances.

The Mayor of the City of Vale, where most of the geothermal potential lies, expressed a real need for the city and county to develop geothermal ordinances.

The people's concerns spurred Malheur County's Planning Department to initiate and develop Oregon's first County Geothermal Ordinance. The Geothermal Ordinance was adopted by the Malheur County Court on June 19, 1974 (See Appendix X).

According to the Malheur County Planner and District Attorney, geothermal development is included in the present Malheur County zoning ordinance. Geothermal exploration and development is permitted under conditional uses with the approval of the Malheur County Planning Commission. Therefore, any company wishing to conduct geothermal or mining exploration and development on private lands must submit their plan to the Malheur Planning Commission for approval.

III. Analysis of the Proposed Action & Alternatives

A. Anticipated Impacts

General

The initial development of the geothermal resource is a step by step development with each succeeding step dependent upon successful indications in the previous step. Normally, however, field exploration, test drilling, and production testing, occur at the same time. During these stages, approximately 30 to 100 men will be required, if successful indications are received, for a period of up to a year. At this time if the field has proven successful, field development will commence. This stage may last from three to five years. During the field development and power plant construction stages, employment may reach 150 to 250 people. One to two power plants can be expected to be constructed a year during the construction period until the potential of the field is reached. Most of the men employed will be temporary construction and drilling workers. If the geothermal resource proves to be large and over an extensive area, all steps in the development process may occur simultaneously over an extended period of time.

There is an estimated five year time lag between the issuance of a lease and the production of the first electric energy.

After maximum development has been attained and electric energy is produced on a regular basis, five people per 100 megawatts are normally required for operation and maintenance of the generating facilities. Five people per 100 megawatts are also normally required for operation and maintenance of the steam field and pipelines. As wells tend to play out, new wells will be required. Approximately twenty permanent people will be required for this work.

Two hundred families moving into the area will cause an impact on the economic and social aspect of the area. Even the 30 people required for operation and maintenance will impact the City of Vale.

The economic impact will be two fold. With the influx of workers, a burden will be placed on the community for services and goods. The retail establishments will again feel a pinch when the workers leave.

Geothermal development requires substantial investment in drilling wells and construction of roads, pipelines, power plants, and transmission lines. All the investments result in an increased tax base for the area of development.

A significant part of the land within the EAR area is private land. Therefore the Malheur County Land Use zoning ordinance and Building Codes will play a large part in the development of the geothermal field.

The private lands adjoining the National Resource Lands are zoned for exclusive farm use (F-1), general farm use (F-2), and rural residential (R-1), on the Malheur County zoning maps. Under exclusive farm use (F-1), general farm use (F-2), and rural residential (R-1), conditional uses are permitted for mineral exploration which includes geothermal exploration and development. Any company wishing to conduct geothermal exploration and development on private lands must submit their plans to the Malheur Planning Commission for approval. The reviewing process and the enforcement of existing ordinances will increase the work load commitments of the Malheur County Planner and Malheur County Planning Commission. It will also create an additional work load on the County Planner, District Attorney and County Planning Commission by necessitating the development of new ordinances and/or revising existing ordinances.

Although it is not the responsibility of this analysis to cite impacts that will occur from development on private land, it should be recognized that they will be similiar to the impacts from development on Federal land. The impacts from development on private land may very well be much more serious and numerous as private land has more intensive use and is closer to concentrated human habitation than the Federal land. The drilling of wells with associated sounds from power sources such as large engines of drilling rigs running continuously, construction equipment, unloading and racking of drilling pipe, venting of compressed air and cuttings (noise and dust) during dry drilling phases, and venting of steam from wells after completion, are principal sources of noise. Excessive noise and dust levels can pose health and safety hazards to residents and visitors to the Vale area. These excessive noises and dust particles could become annoyances to people at night as well as the daytime and could affect their attitudes and expectations of their community.

1. Exploration

Exploration operations may involve both airborne explorations, which do not require physical presence on the ground, or surface exploration. Surface exploration includes both casual use, which generally does not result in significant disturbance of the environment and intensive use which may result in serious disturbance of the environment to varying degrees. Intensive use can involve actions such as construction of

temporary access roads or trails, clearing of vegetative cover for an exploration site, movement of heavy equipment and vehicles cross country, etc.

The soils within the EAR area are susceptible to wind erosion. As vegetative cover is destroyed or removed, airborne dust particles will increase and air quality decrease in direct ratio to loss of protective vegetation. Several sand dunes and/or blowout areas occur in the area. The disturbance of the vegetative cover may increase the size or number of the dunes and/or blowouts.

Road construction, moving heavy equipment, etc., not only destroys the vegetation but channels over surface water flow. This increases the run-off water's ability to carry sediment, plus increasing scouring action of run-off. Increased soil loss and stream sedimentation results.

Increased human activity on the land within the area increases the potential for accidental fires. The soils of the area are very susceptible to both wind and water erosion. Loss of vegetation destroyed by fire will increase soil loss.

Shallow test drilling could contaminate ground water aquifers. Construction of access roads and trails, movement of heavy equipment and vehicles across country, leveling and clearing of drill pads, and drilling will adversely affect the local landscape characteristics. Exploration will have a light impact on the native fauna and livestock. The impact will vary by species due to various tolerance levels of human activity. Mule deer, antelope and livestock use of the area will likely shift to adjacent areas or different parts of the pasture where human disturbance is less or absent. The several raptorial bird species may also frequent the area to a lessor extent. Vegetative disturbance and habitat disruption will be limited to actual sites of intensive exploration or road construction. The impact of this disturbance will be minimal to the local fauna and domestic livestock.

Recreational use of the Federal land will be impaired somewhat. With increased human activity chukar hunting will probably be non-existent. Most of the other recreation, motorcycling, hunting small non-game mammals or predatory animals, horseback riding, and hiking, will not be affected.

The Oregon Trail ruts and their setting are of such significance as to meet the qualifications for inclusion in the National Register of Historic Places. Any exploration or development disturbance in the vicinity of the ruts could damage the integrity of the Oregon Trail resource.

2. Test Drilling

The environmental impacts from test drilling will be effected by the size and type of drilling equipment. Use of large drilling rigs will require road construction and construction of a drill pad. Removal of vegetation from two to three acres may result. This site will have to be considered heavily impacted in regards to the general landscape due to the leveling of the land and pit digging and intrusion of the equipment. The road construction and actual drilling will contribute only a moderate impact to the environment considering the present landscape, i.e., existing roads and powerlines and towers. However, the cuts and fills, grading and dust will make a visual impact. Improper abandonment of field camps could contribute to degradation of the environment by trash, drilling wastes and unrestored surface disturbances. The possibility of blowouts appears somewhat greater in the test drilling stage than in the following stages. In New Zealand a large crater was formed after a blowout occurred. However, due to the heterogeneous character of the present landscape - rolling sage land and steep sided buttes, the creation of a crater would only moderately alter the overall landscape form.

Operation of gasoline powered motor vehicles used to move men and supplies and diesel powered trucks, drill rigs and construction equipment necessary for test drilling and subsequent development phases can contribute pollutants to the atmosphere. The quantity of pollutants from internal combustion engines is expected to be small in comparison to pollution from present vehicular movements over existing local roads, but vehicular movement related to geothermal activity will result in some increase in the pollution load to the local atmosphere.

Particulate matter, in quantities greater than natural windblown dust or dust generated by present vehicular movement over untreated local roads, will be added to the atmosphere as a result of geothermal related vehicular movement on untreated or unsurfaced roads and from earthmoving activity during construction of drill pads and related construction projects. Construction activity will also create temporary vegetation free sites, which will be subject to a greater degree of wind erosion than natural undisturbed ground. Dust generated as a result of geothermal related activity will contribute to the degradation of air quality in the vicinity of the geothermal development. Quantitative measurements of

the potential increase in particulates, as a result of geothermal activity have not been documented, but no serious impacts are anticipated. In addition, to possible degradation of air quality, the settling of particulates on surrounding plant life may have some influence on their growth and survival.

The potential adverse environmental effects of accidental releases of geothermal fluids include waste of the resource, noise nuisance, air contamination from gaseous emissions, pollution of surface and ground water resources and hazard to health and safety (bodily injury to workers, both at the initial event, which may be sudden and violent, and in subsequent control attempts).

As mentioned previously, construction activities increase the chance of soil loss through wind and water erosion. This is especially true if construction is undertaken in the areas of active sand dunes.

Activities relating to test drilling increase the potential for increased sediment loads and dissolved solids in stream flow. Solid waste and bacterial pollution potential increases with increased human activities.

The impact of the test drilling operations may affect wildlife and domestic livestock at the actual site of the drilling operation. Road construction to enable the movement of heavy equipment to these sites will have a moderate impact on the habitat of the native fauna and welfare of the livestock.

The disturbance caused by man's activities and machinery operation will cause some species of animals - such as the mule deer, pronghorn antelope, and certain raptorial birds - to vacate the vicinity. Most of the other animal species which inhabit the area have rather high tolerance levels of human disturbance. Livestock will move to other areas within the fenced pastures to avoid any disturbance.

If brine, either running free or in ponds exists, livestock and wildlife may drink it and get sick and possibly die. Livestock and wildlife may get into mud sumps and get stuck or get sick from drinking from it.

Recreation activities will be affected only slightly more then the previous stage.

3. Production Testing

Production testing requires venting of the well to the atmosphere over a period of time. Venting is accompanied by vapor release and noise.

Non-condensible gases, such as carbon dioxide, methane, hydrogen, nitrogen, argon, carbon monoxide, hydrogen sulfide, radon, ammonia and vapors such as boric acid and mercury are often associated in varying amounts, with steam from geothermal sources. These gases and vapors make up less than 3 percent of the total steam fraction.

Although present in small percentages, some of the non-condensible gases and vapors may pose possible pollution and health hazards. Bleeding and venting of steam wells will introduce these gases and vapors into the atmosphere during and after the production testing phase. Of these gases, hydrogen sulfide ranks number 1 as the most prominent potential environmental hazard. In addition to being toxic, H_2S has a nuisance odor of rotten eggs and is detectable in concentrations as small as .025 ppm. During stagnant air and air inversion conditions, H_2S could accumulate locally from a geothermal operation to a high nuisance level, and perhaps a mildly toxic level. Other gases and vapors could increase to toxic levels from geothermal operations.

Noise, gases and activities associated with production testing will reduce the suitability for use of the area for other resource use. Production testing will conflict with use of the land by wildlife, livestock and recreation, at least temporarily.

4. Field Development

Field development in a large field will continue for several years as new wells and additional power generating units are developed. Since most environmental impacts are cumulative, such as water and air pollution, proper care must be exercised at each step.

The noise level for any geothermal lease area can be expected to increase as a result of the various phases of geothermal activity. Movement of trucks and other vehicles, drilling of wells, venting of steam and other associated sound sources all tend to raise the background noise level.

Open burning of trash and wastes, including brush from land clearing operations, on geothermal leases will contribute pollutants and particulate matter to the atmosphere with resultant degradation of local air quality. Accidental brush fires will contribute to air pollution and may endanger wildlife, structures, and human life.

An additional health and safety hazard is introduced during field development. Asbestos, alone and in combination with fiberglass, is used as an insulating material around pipelines, as sheathing on cooling towers, and for various other uses during and after this phase of development. If concentrations of airborne asbestos fibers accumulated in enclosed fabricating or storage areas, the fibers could be inhaled by workers during fabrication, storage, or field installation, posing a health hazard.

As the development proceeds through test drilling and production testing, physical land modification and disturbance increases. The direct consequence of this is greater landscape deformation and greatly increased potential for wind and water erosion. Soil loss accompanied by higher sediment loads could become costly.

The impact on water supply during the field development phase will be similar to that from earlier activities. Possible local water pollution by blowouts, spillages and leaks will be greater.

During the field development phase, the possibility of water pollution or possible blowouts, due to failure of casings and/or cement jobs, exists at wells that have been completed and then shut-in before finally being connected to a power plant. It is also possible during this period for a casing leek or poor cementing job to go undetected allowing steam and brine to migrate into shallow aquifers.

All species of fauna, including livestock, in the area will be highly impacted during the field development stage. Habitat destruction will be complete at the specific sites of development. Disturbance from high intensity human activity will also impact the animals utilizing habitat near the sites of intensive development.

By this stage of implementation, it is felt that all but the most tolerant animal species will have been driven from the

developed area. Those animals which are tolerant to human presence and activity make up approximately 35% of the fauna (excluding the insects) and, by far the more populace species, e.g., the numerous species of rodents.

If field development operations are carried on during the normal grazing season, the impact on livestock in the area will be high. The livestock may be crowding fences trying to vacate the area.

Nearly 100% of recreation use will be shut off during this stage and the following stage. The ORV use in the area will be displaced and concentrated elsewhere and the motorcycle cross country course will have to be relocated.

With the substantial increase of people and families during this stage, the increased demand for housing and trailer rental space, contractor services, and demand on commercial business, schools, and city and county government will be significantly increased. Although these demands will probably be spread out between Vale, Nyssa, and Ontario, potential problem areas still exist.

Much of the work requires use of semi-skilled labor. As has already been demonstrated in the farm labor market, the local labor force is not adequate to meet seasonal labor needs; therefore, laborers will have to be imported from outside the area. Many people in the labor market may not be readily accepted by the local community. The introduction of a labor force composed of people from different backgrounds, sub-culture or life styles may cause some tension.

The only known mineral values are the gravels throughout the area. Gravels are very plentiful in the area and the loss of this land to gravel production would be of little significance. Oil and gas reserves could possibly be discovered and developed in conjunction with the geothermal resources. Geothermal exploration may in fact complement oil and gas exploration.

The existence of the old mining claims could possibly be a legal obstacle which would have to be overcome to develop the field but this is not considered likely.

5. Powerplant and Powerline Construction

Venting of steam to the atmosphere can create an adverse environmental impact as described earlier.

The clearing and grading of the powerplant sites, construction of access roads or trails, installation of steam pipelines and powerplant construction will result in vetetative and surface disturbance. Soil disturbance and movement, disposal of vegetation and construction wastes, handling of materials, equipment and supplies, etc. will result in temporary environmental impacts such as noise, dust, surface run-off, siltation, smoke, etc. Similarly, powerline construction may involve clearing of rights-of-way, construction of temporary and permanent access routes, erection of towers and lines, etc. Potential environmental impacts involve factors such as soil movement, erosion and siltation, dust, disposal of vegetative waste, etc. Where power lines involve relatively steep slopes, the potential of environmental damage is increased.

Conflicts with recreational uses will occur because of reduced accessability or elimination of area availability due to safety problems.

Greatly increased sediment loads could result from construction activities. Not only would present low water quality decrease even further, but flooding and road and improvement damages could also occur.

Construction of generation and power transmission facilities will result in the alteration of the aesthetic qualities of the area by changing the land use to an industrial development. Landscape changes will result from the removal of vegetation, from soil disturbance to accommodate roads, buildings, steam wells, pipelines and transmission lines and from the man made structures placed upon the site. The impact will not only occur at the site but also on linear corridors occupied by power transmission lines and along steam pipelines that will lace the terrain radiating out from the power plants.

Noise and increased human activities will result in loss of wildlife values, including both habitat and recreational use of wildlife.

The construction stage will likely be the period of maximum disruption to the fauna and the associated habitat of the EAR area. All but some of the most tolerant animals will

probably have left the area during this time. Several of the rodents, a few of the most tolerant birds, and the majority of the insects, will likely remain within the area.

If construction operations are carried on during the normal grazing season, the disturbance will have a high impact on livestock in the area. Stock may have to be removed from the immediate area.

The size work force required during this stage will be approximately the same as the previous stage. Therefore, any stress on the community that occurred during the previous stage will likely continue.

There will be an impact on governmental services such as garbage pickup, new houses being built in accordance to zoning ordinances to accommodate people, health services, improvement of roads and bridges, etc. The movement of heavy construction equipment and generators, construction supplies and materials, and travel of construction workers will put a burden on the State and County roads and bridges in the County area especially in the Vale vicinity. The commuting of construction workers from Ontario and Nyssa to the work sites will add an additional burden to the existing heavily traveled highways in the area, especially the highways between Vale and Ontario and Vale and Nyssa. The accident rates can be expected to increase on these roads as light vehicles and truck traffic increase. This will increase the burden on State and County law enforcement agencies.

6. Operations

Non-condensible gases are vented to the atmosphere during power generation from the gas ejector vents on the condensers and from the cooling towers. Release of such gases can effect air quality in the vicinity of the power plant and, if noxious gases are present in sufficient concentrations, may pose a health hazard to employees at the plant.

Any accidental discharge of steam, due to the rupture of pipelines or a well blow-out, will yield gases and vapors to the atmosphere.

If a gas extraction process is installed at powerplants, concentrated gases and vapors, if accidentally discharged, can increase the concentration of pollutants to the atmosphere.

Erosion from roads and the construction activities, if not properly conducted, can result in added siltation of aquatic

habitat within the area of project influence. The siltation will be most severe during construction phases, although some might extend into the operational stages.

If sump ponds or other impoundments are required during development, or operation phases, the possibility of embankment failure exists. If ruptures should occur, soil erosion and pollution will occur. Water quality may also be impacted through the addition of toxic chemicals as well as increased sediment load to the Malheur and Snake Rivers. Removal of large quantities of subsurface fluids can result in subsidence.

If deep injection wells are used, possible contamination of ground water aquifers can occur. Extensive experience in fluid injection in the petroleum industry indicates this will not be a problem.

If corrosive fluids are produced by the wells, the equipment for handling such fluids, or inside surfaces of such equipment, must be made of suitable corrosion-resistant materials. This would be normal design practice to assure reasonable life for the equipment; it also is necessary to prevent leaks and spills which can result in contamination of surface waters.

There is a broad range of potential adverse and beneficial effects on water resources which may result from full-scale operations. Environmentally significant alterations can occur in the ground water and surface hydrologic regimes and in the availability of water suitable for human, agricultural and industrial needs as a result of injection or waste disposal operations. Such impacts could be felt both on the immediate leasehold and adjacent lands as well as over a much larger area. For example, a decrease in stream flow through water withdrawal for geothermal activities could adversely affect a drainage basin for a distance of many miles downstream or even an entire drainage basin. Conversely, the use of electric power from a geothermal field for a desalination water project or the by-production of fresh water may beneficially serve a community in an outlying region or in the area adjacent to the geothermal operation.

The ground water regime in the general area of a geothermal field may be altered if appropriate protection and control

procedures are not employed. Fresh-water aquifers occur above any geothermal reservoir likely to be discovered. If the geothermal reservoir contains hot mineralized or saline water, tapping the geothermal strata can result in contamination of the fresh water aquifer if one horizon is not kept isolated from the other by properly cementing the casing of either production or re-injection wells. Beginning with the early stages of a project, suitable data must be accumulated and thoroughly analyzed, to determine what steps must be taken to prevent or minimize alteration of the local groundwater regime.

Experience in petroleum production indicates that marked changes in reservoir pressure, whether due to pressure reduction from the production of fluids, or to pressure increase due to injection, may in certain types of reservoirs, especially in faulted or fractured rocks, result in instability leading to seismic activity. Such instability due to production alone has been documented in the Wilmington Oil Field, California (Poland and Davis, 1969, p. 205) and instability due to injection was documented at the Baldwin Hills Oil Field, California (Hamilton and Meehan, 1970) and in Colorado (Healy and others, 1970). The role of fluid-pressure changes in triggering seismic action is not well known but a causative relation has been established in many areas. In general, such earthquakes have not been damaging but the potential for major seismic action cannot be ruled out. The injection of fluids along a fault zone may indeed result in a series of minor quakes but it may serve to release the stored up energy and prevent a major quake. This technique is a major area of study in California and proponents of controlled fluid injection along faults are growing rapidly.

Subsidence of the ground surface over and around a geothermal reservoir can result from the withdrawal of large volumes of fluids (Poland and Davis, 1969; Hunt, 1970). Subsidence would reach a maximum rate during full-scale operations unless replacement fluid is returned to the reservoir. In some instances it may be practical to re-inject the geothermal fluids after utilizing most of their heat. Studies would be required prior to approval of operating plans and operation would have to be monitored to determine the subsidence potential and its probable consequences.

Drilling and fluid production will involve the same considerations during full-scale operations as during the testing and earlier production operations, inlcuding prevention of blowouts, sealing of wells and providing for control of fluid flow from a well. Steam not containing noxious gas concentrations generally can

be exhausted to the atmosphere without causing significant environmental damage if noise is kept at a moderate level. Condensing such steam can result in greater heat recovery and even augment fresh-water supplies.

Full development of a geothermal field (as with drilling, production testing, field development and power-plant and power-line construction) can have varied impacts upon fish and wildlife. Most of the impacts will occur on or adjacent to, the power generation plant sites and areas occupied by related facilities. There can also be impacts upon fish and wildlife from improper handling of geothermal fluids. As a geothermal field proceeds through the stages of power-plant, road, transmission line and any by-product facilities construction and operation, the loss of wildlife values, which began in the test drilling and production testing stages, will vary by nature of activity. The impacts of exploration, development and construction generally will tend to be of a temporary nature during the period of such activity. Impacts associated with the operational phase will continue during the life of the plant, but even here some wildlife will accept such environmental intrusion without serious consequences. Impacts can include both wildlife habitat and usage. The fauna will surely differ from that prior to initial exploration. Certain species may be favored more than others by habitat change. Existing public access will be restricted to reduce hazards to the public or to protect plant facilities with an accompanying reduction of hunting and other recreational opportunity on these lands. Power distribution lines located in flyways or over nesting and feeding sites may cause some mortality of waterfowl, eagles, hawks and other birds from collision and/or electrocution.

The by-product potential of some geothermal developments is expected to be of commercial interest. Heat may be extracted from geothermal fluids for purposes other than power generation, thereby increasing the overall thermal use efficiency and precluding the need for providing alternative sources for an equivalent energy source. It also may be feasible to extract valuable chemicals and potable water from the brines produced. Such by-products can represent positive, beneficial environmental influences. Safeguards must be employed so that waste streams from by-product plants do not contaminate or adversely affect the environment, for example, by contributing to air or water pollution.

The operation and maintenance stage will have little impact on livestock if proper access structures are available under the pipelines. The livestock will soon become acquainted with the

activity and structures and accept them as part of the environment.

The demand on governmental services, schools, housing, commercial businesses, hospitals, and health services will decrease. People of the county will be receiving benefits from the development through perhaps lower taxes as a result of the increased tax base on facilities of the geothermal development. The increase of available electric power may increase industrial growth in the area.

Adverse affects on the landscape will decline during this stage since there is less equipment, people and disturbance.

No areas of slope instability have been specifically identified within the KGRA Addition. Portions of the Chalk Butte Formation, however, are known to contain components of montmorillonite clay. Strata with a significant montmorillonite content may be prone to slumping or mass wasting on exposed slopes and cuts where subjected to repeated cycles of wetting and drying.

Cuts into the toes of slopes should be avoided.

B. MITIGATION MEASURES

Mitigation of potential environmental problems and impacts stemming from geothermal exploration and development activity can be accomplished through enforcement of applicable federal, state and local laws and regulations, geothermal exploration and leasing regulations, geothermal operating regulations, Geothermal Resources Operational (GRO) Orders, lease and land-use permit stipulations, and application of existing and developing and yet to be developed technologies. Although the number of geothermal installations in the world is limited, a great amount of technical and operational information has been gained from them. Certain technologies, such as drilling methods and handling of high pressure fluids, have been directly transferred with appropriate modification, from the petroleum industry to the geothermal industry. Our knowledge of environmental causes, effects and remedial or preventive measures specifically relating to geothermal development ranges from adequate to limited. Some environmental impacts are known and can be prevented; some impacts can be anticipated and adequate environmental protection can be planned; some impacts can only be hypothesized so contingencies included under the general regulations may provide a means for corrective action in the event these impacts become reality. If unacceptable environmental factors exist which cannot be corrected, development or operation would not be permitted.

If a significant geothermal resource is discovered, one involving two or more power generating plants, it is probable that development will occur over a period of years. This probable prolonged development period of itself tends to be a mitigating measure in that problems discovered in initial operations may be solved and taken care of in succeeding operations. If problems develop which cannot be satisfactorily solved, the regulations provide for shutdown of operations until such time as acceptable corrective action is taken.

Exploration

Section 3209.2 of the Geothermal Regulations provides that no exploration operations will be conducted on public lands except pursuant to the terms of a Notice of Intent which has been approved by the authorized officer. Section 3209.1-1 sets forth the requirements for filing such a notice. Special provisions relative to the particular area involved will be included as appropriate to assure adequate environmental protection in connection with such exploratory operations.

Monitoring

Monitoring will be conducted for all potential impacts related to exploration, development and production of geothermal resources. Such impacts include noise, air quality, water quality, radioactivity, erosion, fish and wildlife and land subsidence.

Monitoring of noise, and air quality, which are readily identified and associated with specific activity on an individual lease, will be the responsibility of the lessee, under the supervision of the U. S. Geological Survey and will be required as a stipulation in the lease or through Geothermal Resources Operational (GRO) Orders.

Monitoring of changes in water quality, sediment yield, fish and wildlife values, erosion and land subsidence will be the responsibility of the Department of the Interior (Refer to 30 CFR Parts 270 and 271, 43 CFR Part 3200, and Secretary Order 2948).

Land Resources

The term applies to those surface oriented activities and operations affecting the surface such as aesthetic values, erosion control, and land stability problems.

Section 3204.1 (f) of the Geothermal Regulations requires that aesthetics be taken into account in the planning, design, and construction of roads, pipelines and facilities. Careful planning, design, and supervision of operations should lesser the undesirable impact of such operations. The overall impact will be lessened if operations can be conducted out of sight of main public access routes. Facilities should be blended into the background as much as possible to minimize the contrast with the natural setting. Power plant buildings should be designed with minimum profiles. Facilities and pipelines should be camouflaged by proper selection of paint color. Roads should be constructed to minimum necessary width and as much as practical following the natural contour.

All of the public land in the EAR area is managed under the multiple use concept involving such uses as recreation and grazing. The principal measuresassuring multiple use of the surface are contained in Section 3204.1 (b) of the Geothermal Regulations which assure public access to leased land and limits restrictions on access by the lessee to those consistent with health and safety requirements. Lands in the vicinity of wells, pipeline, and power plants must be restricted from hunting and general access in the interest of safety. Fencing will be required at hazardous locations.

The chances of seismic action originating from geothermal development cannot be estimated. However, it is also possible that reinjection of fluids especially along fault zones may result in a series of minor quakes which serve to release the stored up energy thus preventing a major quake. As stated previously, this technique is a major area of study in California.

Livestock grazing and geothermal operations should coexist satisfactorily with proper planning as required under Section 3200.0-8(b). Examples of actions which can be considered to insure minimum impacts on grazing include:

1. Harassment of livestock will not be permitted.

2. Livestock management facilities including fences, cattleguards, pipelines and water troughs will be repaired or reconstructed if they are damaged by geothermal exploration or development.

3. Fence mud sumps and other areas which might endanger livestock.

4. During the field development and construction stages, livestock may have to be removed to insure their safety and welfare.

5. Construct pipelines so as to prevent a drift fence effect.

6. Provide a suitable number of pipeline crossing areas and cattleguards.

7. No developments or drilling within one-quarter mile of all livestock watering facilities including reservoirs, troughs and wells.

Erosion Control

Section 3204.1(c)(4) of the Geothermal Regulations requires minimum disturbance to vegetation and natural drainage. The lessee will be required to employ adequate conservation practices on the leased land. Compliance will also alleviate potential downstream impacts from increased sediment load. Stream sedimentation may also be regulated by state water quality authorities. Mitigating measures include reseeding of disturbed areas, dust and erosion control on roads, well sites, and construction areas, and sound engineering practices in construction of roads, drill pads and structures. Examples of mitigating measures which will lessen environmental damage are:

1. Road and trail construction shall not block drainage systems or water courses. Culverts or other suitable crossings installed on drainages and the road drained or water barred as necessary to prevent erosion.

2. The slope of cut banks and fill slopes shall not exceed $1\frac{1}{2}$:1.

3. Down spouts should be provided where culvert drains may cause fill cutting and accelerated erosion.

4. All roads planned for permanent or long duration use should be adequately gravelled or paved to control erosion.

5. All access roads and trails, drill pads, etc., will be rehabilitated as soon as possible after abandonment.

6. All disturbed areas should be re-vegetated for adequate soil protection.

7. The top soil on disturbed areas on sites other than for permanent construction shall be stockpiled for use in reclaiming the sites.

8. Sufficient buffer strips of natural vegetation should be left between disturbed soil and drainage bottoms to aid in preventing sediments from moving into a stream.

9. Harmful chemicals should be removed from all sumps and ponds. Upon abandonment, sumps and ponds should be filled and re-vegetated.

10. All rehabilitation measures should be directed toward restoring the area to as near natural condition as possible.

11. Soil disturbance shall be kept to a minimum (vehicle travel will be restricted to roads as much as possible).

Other Land Use Factors

Disposal of waste will be regulated as prescribed by Section 3204.1(a). Mitigating measures which will lessen environmental impacts are:

1. Comply with applicable federal, state and local sanitary and waste disposal regulations.

2. Remove all garbage waste and foreign debris from the area.

3. Any human solid waste will be disposed of through chemical or gas fired toilet facilities on drilling site(s). Suitable sanitary facilities should be provided in power generating plants and other permanent installations.

Air Quality

General provisions for prevention of air pollution and related employee health and safety are included in Sections 3204.1(c)(3), 3204.1(c)(5), and 3210.2-1 of the Geothermal Regulations. Examples of mitigating measures which will lessen environmental damage are:

1. Dust - Dust will be generated by movement of vehicles, construction activity and test drilling. To minimize dust generation, the lessee will be required to:

   a. Keep new road construction to a minimum.

   b. Limit site disturbance in pad and building construction to the smallest area necessary for satisfactory development and use.

   c. Gravel or pave all access roads and trails receiving heavy use.

   d. Gravel or pave all power generating sites.

   e. Control dust, when air drilling by whatever means necessary.

   f. Although not related to dust, require workers to wear protective devices when working with asbestos and fiber glass to prevent breathing airborne particles.

2. Noise - Noise due to steam ejection or expansion, drilling operations, construction activity, and other related geothermal activities may pose serious health and environmental hazards. To minimize adverse environmental effects from noise generation, the lessee should be required to:

   a. Comply with federal and state noise exposure levels established pursuant to the Occupational Safety and Health Act of 1970.

   b. Install the latest muffling equipment on both wells and drilling rigs.

   c. Limit drilling and production so that no geothermal wells are located closer than ½ mile to any populated area (10 or more dwellings within ¼ mile area) without written consent of 75% or more of the owners. In addition, the following minimum distances should be observed in locating a well in areas other than populated areas:

      (1) Outer boundary of parcel - 100 feet
      (2) Public roads - 100 feet
      (3) Residences or other development - 500 feet

3. Gas & Vapors - The venting of steam to the atmosphere can create an adverse environmental impact if the steam contains significant amounts of noxious gases. To protect environmental values, the lessee should be required to:

   a. Comply with national and state primary and secondary ambient air quality standards, as well as safety and health standards when releasing gases and vapors to the atmosphere.

   b. Limit emissions from venting wells or pipelines to short durations.

4. Burning - Burning of trash could contribute to significant air pollution. It is recommended that no burning be permitted.

   To insure that wild fires do not result in environmental degradation, the lessee should make every effort to prevent, control or suppress any fire within the lease. Reports of uncontrolled fires must be immediately sent to the BIM's District Manager or his representative.

   The lessee will be responsible for any fire suppression costs that are determined to result from his operations.

Water Quality

To prevent any deterioration in quality of either surface or subsurface waters, the following measures should be implemented:

1. Comply with federal and state water quality standards.

2. Waste waters will not be discharged into live streams or underground aquifers, except that waste waters may be reinjected into the producing reservoir from which it was withdrawn.

3. Toxic materials will not be released to any surface waters or to any subsurface waters that are suitable for irrigation, livestock, or human use.

4. No discharges to surface water which would result in increasing the sediment load above acceptable limits will be permitted.

5. Cementing and casing during drilling and production will be adequate to prevent contamination of fresh water aquifers.

6. Monitoring will be adequate to prevent casing leaks or cement job failure from contaminating aquifers or resulting in blowouts.

Minerals

There are no major conflicts or impacts anticipated mainly because the lands within the EAR area are essentially without value for mineral resources other than geothermal steam and gravel which is abundant.

Wildlife and Wildlife Habitat

Section 3204.1(g) requires the lessee to employ such measures as deemed necessary to protect fish and wildlife and their habitat. Section 3204.1(i) provides that the lessee shall provide for the restoration of all disturbed lands in an approved manner. Necessary fish and wildlife protection and land restoration measures will be developed on a sensitive basis and included as special stipulations in each lease. Such stipulations should include:

1. *The proper spacing of high voltage transmission lines should in itself prevent any electrocution of birds. Should local use of geothermal power involve smaller, closer spaced lines, then the specifications for power transmission lines developed by Mr. Morlan Nelson, Birds-of-Prey consultant, in consultation with Idaho Power Company and the Buresu of Land Management should be applied. Mr. Nelson's designs are attached in Appendix XIII.*

2. All surplus brine and associated effluents should be reinjected into the appropriate strata to prevent the possibility of contamination of the local watershed and the Malheur River.

3. Areas of vegetal removal and/or soil disturbance should be seeded or planted to native vegetation. Plant species not native, such as crested wheatgrass, nomad alfalfa, etc., might also be utilized where adapted to the sites.

4. Noise suppressing mufflers must be installed on vents to minimize the adverse effect of operational noise on wildlife.

Attitudes & Expectations, Local & Regulatory Structures & Cultural Values

Other than apprising the lessee of county and city zoning ordinances, building codes, etc., and requiring him to comply with local laws, the only method of mitigating impacts of geothermal exploration and development on Attitudes and Expectations and Cultural Values (owners of private land and the people in general) is advising the county and city governments of the potential impacts so they in turn may advise the local citizenry. The mitigating measures required to forestall problems created by a temporary (but possible long term) influx of 30 to 200 people and families will have to be initiated and accomplished by county and city governments and local businessmen and citizens.

Archeological and Historical Values

A proposal has been made to withdraw the public land in a strip one-eighth mile on each side of the Oregon Trail (total of one-quarter mile wide) in order to stop man-made disturbance that could alter or destroy the resource and its setting (Refer to Illustration 14).

Refer to Section 18 of the Geothermal Resource Lease, (Appendix VI), for provisions to protect archeological and historical values.

In addition to the Oregon Trail Historic Area, eleven archeological sites and two paleontological sites have been identified on National Resource Lands within the EAR boundaries. These sites each occupy approximately one-fourth acre for a total acreage of approximately 3¼ acres. Most of these sites are in rugged topography not suitable for a drill site or geothermal plant location. The Lessee will not be allowed to disturb these sites without the express consent and supervision of the Authorized Officer. In order to prevent or minimize vandalism, the exact location of these sites will be revealed only to those with a real need to know.

C. RESIDUAL IMPACTS

Geothermal regulations, lease provisions, and General Resources Operational Orders are designed to assure that geothermal resources can be developed and utilized in an environmentally acceptable manner. In those instances where this cannot be done, development and use will not be permitted. However, virtually any human use of lands and their resources may have some degree of adverse impact. Where benefits warrant acceptance of minor impacts, such uses may be appropriate provided the adverse impacts have been adequately recognized, mitigated to the extent possible, and are not so serious as to preclude the proposed action. The following discussion summarizes the types of adverse impacts that may be unavoidable should the proposal be implemented.

1. Exploration Phase

Exploration activities will involve physical presence upon the land which may result in damages to the land and resources thereon. Exploration activities include, but are not limited to. geophysical operations, drilling of shallow temperature gradient wells, construction of access roads or trails, and cross-country transit by foot, animals or vehicles.

Even though persons conducting exploration operations comply with all of the general and specific terms and conditions of the "Notice of Intent to Conduct Exploration Operations", including the restoration of areas as near as possible to their original condition, some adverse impacts still may result. Examples are:

a. Vehicle travel will result in dust, exhaust gases, noise, disturbance of wildlife, injury or killing of livestock or wildlife, accidents, etc. When existing roads are used, such impacts would be nominal since they primarily would be the result of increased traffic. Advance approval will be required for construction of new roads or trails to assure proper construction and restoration. However, there will be a certain amount of disturbance of vegetative cover and soil surface from cross-country travel on roads or trails that can have temporary impacts until cover is restored and the soil is stabilized. Evidence of such roads or trails may remain for several years which could be conducive to casual use by others resulting in further damage. Failure to comply with

regulations or exploration stipulations could result in similar impacts but damages could be more significant, particularly if such improper use was not promptly detected and corrected.

Disturbance of vegetative cover and soil surface by vehicle travel, both on and off road, as well as road and drill pad construction will result in some soil loss even if all mitigating measures are followed.

b. Drilling of shallow holes or blasting may be necessary which may result in minor vegetative and surface disturbance in the immediate area of activity. All drill holes will be small and shallow and are to be capped when not in use so no damage is anticipated from such holes. If not capped, small animals could fall into the holes and perish.

c. The presence of men and equipment will present additional fire risk in areas of high fire hazard. Even though operators are required to make every reasonable effort to prevent, control or suppress fires started by their operations, there can be accidents, human error or carelessness, equipment faults or failures, etc., which could result in fires that could have serious environmental consequences. Similar risks are associated with virtually any human use of areas subject to serious grass, brush, or forest fires.

2. Test Drilling Phase

Heavy equipment capable of drilling to depths of several thousand feet is required. The enlargement and improvement of existing roads or construction of new roads to provide access for drilling equipment and supplies to the drilling site involves unavoidable impacts from vegetative cover removal, surface disturbance, cuts and fills for roadbed, soil erosion and siltation during construction and, to a lesser degree, some impacts even after banks are stabilized, vegetative cover is restored, and adequate drainage is installed. At each drilling site a level area of approximately one-half to three acres are required for drilling operations. In the steep terrain associated with parts of/and within the EAR area, this could necessitate considerable grading if these areas were selected for drilling. While compliance with lease and GRO Orders will prevent serious adverse impacts, some minor impacts still will result. Most of the potential impacts listed under exploration could be expected with some intensification in areas of heavy activity.

During grading and drilling operations, moderate levels of noise from equipment operations will be unavoidable. Even where special noise control measures are required, noise levels will be above natural levels.

Well blowouts can result in significant venting of steam, associated gases and brackish water to the atmosphere, ground area and surface water, creating air and water contamination as well as high noise levels and exposing individuals to possible injury.

While modern drilling techniques are capable of preventing such accidents, there is still the possibility they may happen due to human error, equipment failure, or other factors. Adverse impacts will continue until the blowout is controlled. The seriousness of the incident could range from minor to serious, depending upon location, nature of geothermal emissions, duration of blowout, etc. Blowouts of wells in that part of the watershed lying above the agricultural lands and irrigation canals will result in significant contamination of crop lands and ditches if waters are highly mineralized. Canals could be washed out with serious soil erosion resulting if volume of water from a blowout is high.

Well blowouts emitting noxious or toxic gases will adversely effect the residents of the town of Vale and surrounding area, especially during temperature inversions or with easterly winds. Depending upon levels emitted and climatic conditions, the effect would range from unpleasant living conditions to unsafe condions for human habitation. Blowouts also could result from subsequent events such as earth slides, seismic action, vandalism, etc.

3. Production Testing Phase

The most significant feature of production testing of vapor dominated systems is the release of high volumes of steam for periods of as long as several weeks or even months. This is necessary until the flow stabilizes at a uniform level. During this period the noise impact and gaseous emissions will be at their maximum level. The degree of noxious gas released to the surrounding atmosphere depends upon the composition of the steam. Release of steam that contains hazardous toxic levels will not be permitted, but the less than

toxic condensations can have odor or other adverse impacts. Noise may disturb wildlife or people.

As mentioned previously, as a result of the proximity of Vale to the land within the EAR Area, releases of even limited amounts of noxious gases will adversely impact the residents primarily during periods of temperature inversions.

In water-dominated reservoirs, production testing likewise requires production of the formation fluid over an extended period. Disposal of produced water could have an environmental impact if the water containing salts or other toxic substances should be released to the surface environment. Large volumes of liquids could be involved. If not properly contained or re-injected, they could seriously impact on surface water quality and related fish, wildlife, or other water-related values.

4. Full Scale Operation Phase

Full scale operation will require complete development of well and steam transmission systems, power generation facilities, transmission lines, permanent roads, etc. Many of the potential adverse impacts associated with exploration and testing will no longer exist but other impacts may increase in proportion to the scale of development. Currently about ten wells are needed to supply each generating station. Each well will involve clearing, grading, and improvements. Steam pipelines connecting wells to the generators likewise require clearing and grading. During construction there will be considerable activity,noise, movement of earth, dust, etc. After construction is completed and all necessary environmental protection measures are taken, the nature of the site will be changed from its former state to an industrial complex.

Even with adequate controls, full scale operations will involve higher than natural noise levels, emission of steam and other gases to the atmosphere, disturbance from operation activities, additional vehicle traffic, etc. Transmission lines damaged from storms or other failures can result in fires or personal injury but to no greater extent than lines built in connection with other power systems under similar conditions.

Potential adverse impacts will be introduced during full scale operation from possible land subsidence or increased seismic activity. Land subsidence can roughly be predicted from tests of core material prior to production. It is known to occur primarily in areas consisting of poorly consolidated sedimentary rocks.

One means of alleviating the potential subsidence problem, the impacts from which being much more serious on private land than on the Federal, and at the same time disposing of unwanted waste water is through pressure maintenance in underground reservoirs by re-injection. This however, can lead to the potential impact of increasing seismicity. The relationship of fluid-pressure changes to earthquakes is not well known. Impacts can be beneficial or adverse.

The intrusion of structures, pipelines, and the transmission lines into this area will create an adverse visual impact. Although this is not a major recreation area, development will nevertheless lessen the aesthetic value.

Extensive development can lead to damage of archaeological sites presently unknown. Discovery of new sites by construction equipment can be beneficial as well as destructive, depending on the amount of damage to the site before it is recognized.

The open desert nature of the area covered by this EAR will have been converted to an industrial complex. A resultant change in wildlife species will unavoidable occur. Raptorial birds, pronghorn antelope, and other disturbance sensitive wildlife will permanently vacate the area. More tolerant species of wildlife, such as the numerous rodents and insects, will continue to occupy areas of suitable habitat. Additional species, not now common to the area may occupy newly created habitat.

Clearing operations, the maze of pipelines, structures, and fences which restrict access will result in a certain amount of loss or livestock forage and grazing area. This may result in over use of accessible areas, shifts of livestock use, adjustment of livestock numbers, or all of these the effects of which may be deterioration of the watershed in the over used areas and increased economic stress on the livestock operators in the case of shifts or adjustments of numbers.

The mitigation of the impact of geothermal development on the attitudes of the general public in the area, the lives of individuals in the area, local businesses, County and City government, schools, and health facilities is beyond the realm of responsibility of this analysis. It is worthy to note that this will, in all probability, be a residual impact and should be recognized.

In summary, there are three major residual impacts that will or may result from the proposed action: there will be an impact on the local communities and community services; if blowouts occur, there is a good possibility that adverse affects will be caused from escaping non-condensable gases and/or mineralized or brine water. The major affects of all three are off site, occurring on private land or to individuals on private land.

IV. RELATIONSHIP BETWEEN SHORT TERM USE AND LONG TERM PRODUCTIVITY:

A. General

The leasing of lands for geothermal resource development involves the commitment of a portion of the geothermal heat, water, and related land areas and resources of the sites involved. It is particularly significant to recognize that the geothermal heat is a wasting resource that otherwise would be dissipated over time from the surface of the earth to the atmosphere with little or no identifiable benefit. By contrast, development of this resource in an environmentally acceptable manner can have substantial benefit by affording a relatively clean power generation energy source.

The exploration and testing phases of geothermal leasing are designed to determine the nature and extent of geothermal resources. Generally the active portion of this phase is of short duration, sometimes extending only over a period of days, months, or at most, a few years. It may be intensive and continuous for short periods or periodic over several years. Where such exploration proves unsuccessful, there will not be subsequent use of the land for development and production of geothermal resources. Under such conditions, leases will terminate at the end of the ten year primary term. However, in many instances such leases will be relinquished by the lessee at an earlier date to avoid additional lease payment costs. Exploration and lease provisions will require that lands disturbed by unsuccessful exploration will be restored as nearly as possible to their original condition upon termination of these activities. Such restoration includes measures such as grading, installing proper drainage, soil stabilization, revegetation, removal of all equipment and supplies, proper removal or disposal of all wastes, filling in of holding ponds, etc. Except for scars from leveling of drilling sites, roads or other major earth movement, the areas should return to natural conditions in a short time. Changes in vegetative cover may result, depending upon whether native or non-native plants are used. Generally the native vegetation will retake the area; however, on some sites aesthetic and vegetative impacts may last over a long period due to the slow natural recovery factors.

Where exploration discloses the existence of economically attractive geothermal resources, the development and production of such resources for electric power generation, and possibly water and mineral by-products can be expected to occur. Timing of such development will depend upon electric power markets, power transmission systems, construction schedules, etc. Once production begins the geothermal resource will be withdrawn at a rate greater than the natural replenishment rate. Over a period of years (perhaps 20 to 50 years, depending upon the

nature of the resource province) production capacity will be depleted to the point where further operation will not be economically feasible. When the reservoir is no longer capable of sustaining the geothermal operation, the leases will be terminated, the facilities will oe dismantled, and the land will be restored, insofar as practicable, to its original condition. Most of the area involved in the operation will have become well stabilized except for the actual areas used for the generation facilities, roads, or other structures or facilities. Removal of improvements will result in some disturbance, particularly in well and steam pipeline areas, but such disturbance will be of a temporary nature and subject to appropriate restoration. Unless the land areas occupied by production facilities were to be used for some subsequent and nonrelated purpose, they will be properly graded, drained, stabilized, and revegetated so that they will again become a part of the natural environment. Relatively large areas of level land will remain, such as the power generator site. Cuts and fills for roads, steam pipeline routes, etc., likewise will remain visible. However, the combination of restoration and natural vegetative recovery will, over time, result in a near natural setting with only contour change as evidence of prior uses. The lands will return to their former productivity or they will be available for other appropriate uses.

B. The Resource

By developing geothermal resource potentials, a previously unused natural resource will be tapped to help meet the Nation's growing energy needs. In terms of total energy requirements, the contribution of geothermal resources may be relatively small but it can be important, particularly on a local or regional basis. The generation of power will be the principal use of geothermal resources; however, there also is a possibility that by-products of water or minerals might be possible. In many cases the geothermal resources may not be of sufficient temperature to be useful for electric power production but will be useful for space heating or industrial processing.

While depletion of some of the heat within the geothermal reservoir will occur over the period of operations, no permanent adverse effect is anticipated. Over time, perhaps a hundred or more years, natural heat transfer within the earth might even return the heat content to nearly the same intensity as existed before utilization. At some time in the relatively distant future it might be possible for such areas to again be used for similar productivity. Any use of by-product minerals probably will represent mineral recovery that otherwise would never have occurred. Such use will preclude the need to obtain a like

amount of such materials from other sources. Where waste waters are reinjected, the associated mineral values will be returned to the earth.

C. Water

The consumptive use of water resources, primarily geothermal fluids, in the power generation or mineral by-product process will constitute a depletion of the gross water resources of the area. To the extent that geothermal fluids are withdrawn from the subsurface reservoir and not replaced by reinjection or natural recharge, the waters so consumed represents depletion of water in storage. However, in most instances, due to high mineral content, this will be water that otherwise probably would not be used. If subsidence should occur, the water storage capacity of the geothermal reservoir will be permanently reduced but since such waters probably could not be used for other purposes within the foreseeable future, the reduced storage impact may not be adverse in terms of future water productivity.

Geothermal fluids may also be of sufficient purity to be used directly for irrigation or other purposes after the fluid has been cooled. This could provide a source of fresh water during the period of power operation and it is possible that the wells could continue to be used even after power production has ended. In some areas, the geothermal fluids are expected to be concentrated brine which will not be suitable for any other purpose. In such situations, the wells will be sealed upon termination of power generation. The use of such water should not affect water resources available for beneficial use.

Under the proposed controls for waste disposal, degradation of surface and fresh ground waters is not expected to be significant, especially in a long-term sense. Mishaps or accidents may have short-term impacts that, depending upon the volume and nature of discharge involved, could be serious, particularly on aquatic resources. However, corrective measures such as dilution, diversion of waste waters from streams, capturing in impoundments, etc., should provide adequate measures against serious or long-term impacts.

D. Land

Land uses during the period of production operations will be changed to industrial operations from wildlife habitat, recreation, and grazing. However, many such uses can continue on a reduced compatible basis. Wells, pipelines, power plants, by-product facilities, and power transmission facilities will dominate the local area. Public access in the vicinity of such

facilities will have to be restricted to protect the public and the facilities. Development and production of geothermal resources generally are not expected to have any lasting or inhibiting effects on the use of the land after geothermal operations have been concluded and facilities have been removed.

Should geothermal production result in land subsidence, which is an irreversible process, the subsidence constitutes a long-term effect on the land resources. Such subsidence, however, will not significantly affect use of the public land in the area covered by this EAR.

E. Wildlife and Recreation

Geothermal resource development could result in certain localized adverse impacts on wildlife and their habitat. There could be a loss of wildlife habitat in the immediate vicinity of installations and minor loss of birds from collision with electric distribution lines. In addition, restrictions of public access will reduce hunting and related recreational opportunities in the vicinity of installations. A change in the natural setting of lands could result in long-range effects on wildlife by rendering some lands less desirable for wildlife habitat purposes. In some instances, wildlife species such as the Townsend ground squirrel, starling, English sparrow, and American magpie may benefit from development activities. Reduction of ORV use in this area may cause ORV use to become concentrated elsewhere. This concentration could intensify soil erosion and other problems in adjacent areas.

F. Economic and Social

Geothermal development requires substantial investment in drilling wells and construction of roads, pipelines, power and by-product plants, and transmission lines. Such investments result in an increased tax base for the area of development. However, the labor-intensive phase may be short-term, occurring primarily during field development, and would result in significant changes in population distribution. The economic benefits probably would have to be developed elsewhere if the geothermal resources were not developed. Illustrations 16 and 17 reflect estimated costs of electricity from variously fueled plants. Generally, the costs for a hot water geothermal plant are comparable to hydroelectric, nuclear and oil fired plants. Dry steam plants are much less costly, but few dry steam sources are expected to be found. Gas fired power plants have a cost advantage but, due to the increasing scarcity of natural gas, continued use of remaining supplies represents a waste of this cleanest of energy resources. Coal fired plants appear to have a cost advantage, provided increasingly stringent air quality standards can be met without significant increases in coal production or utilization processes.

Geothermal resources can be economically competitive where such resources can be developed near existing power systems or where additional transmission costs are nominal. Since the generation capacity at each site may be small, substantial investments in power transmission systems could cause such development to be uneconomic.

Damage or destruction of the Oregon Trail resource would be at the expense of the education and enjoyment of future generations. There could be additional aesthetic or social impacts in terms of increased noise levels, odors, additional traffic, etc., even though all of the environmental stipulations of the permits are met. These will be minor but objectionable in terms of pre-operational conditions. Since such operations could continue for a period of 25 to 50 years, they would exist during most of the lifetime of local residents or users of this area.

Estimated Cost of Electricity From Variously Fueled Plants

Item	Gas-fired* 1/	Coal-fired* 2/	Hydro-electric	Nuclear**	Geothermal* (Hot water)	Oil-fired* 1/
Unit investment cost of plant $/KW 3/ (July, 1974)	260	310	390	575	4/ 160	350
Annual fixed charge, percent of investment 5/	17	17	17	17	4/	17
Killowatt-hours generated per year per KW capacity 6/	7,000	7,000	7,000	7,000	7,000	7,000
Heat rate 7/	10,000	9,500	--	10,600	15,700	10,500
Cost of fuels, cents/million Btu	69.6 ('74)	20.3 ('71)	--	17.5 ('71)	8/ 17 ('74)	2.40 ('74)
Cost of electricity, mills/kwh						
Plant investment	2.6	5.5	9.5	7.3	2.3	2.8
Operation & maintenance	0.6	0.8	0.1	0.4	1.5	0.7
Fuel	3.5	1.9	--	1.9	5.9	6.5
Total	6.7	8.2	9.6	9.6	9/ 9.7	10.0

1/ Outdoor type plant.
2/ Indoor type plant. All figures valid only for western states.
3/ Includes land, structures, boilers, turbine generators, electrical equipment, miscellaneous plant equipment. Excludes switchyard.
4/ See following page for explanation of investment costs and annual fixed charges.
5/ Includes cost of money, depreciation, interim replacements, insurance and taxes.
6/ The 80 percent operating factor used here is applicable only to base load plants. Hydro is seldom a base load plant.
7/ Varying heat rates representative of power plants under consideration when base loaded.
8/ Cost of fuel based on capital and operating costs of steam-winning system. (July, 1974).
9/ Comparative cost for dry steam approximately 5.3 miles.
* Derived from 17th steam station survey, Electrical World, Vol. 176, Nov. 1, 1971 (recent price increases not reflected).
** Derived from Hottel and Howard, New Energy Technology; article by Benedict, "Electric Power for Nuclear Fusion", Proceedings of National Academy of Science 68.

Illustration 16

Geothermal Plant Investment and Annual Fixed Charges 1/

Item	Unit investment costs	
	10-year life	30-year life
Production well system	$ 48	$ 25
Injection well system	75	32
Make-up water system	7	8
Sub-total, steam winning system	$130	$ 65
Generating plant 2/	0	95
Total	$130	$160
Annual fixed charges percent of investment 3/	23	17

1/ Steam-winning costs based on Geothermal Resources Investigation, January, 1972, by Bureau of Reclamation. Costs escalated to reflect inflationary trends in construction industry.
2/ Includes structures, turbine generators, electrical equipment, miscellaneous. Excludes land, steam-winning system, switchyard.
3/ Includes cost of money, depreciation, interim replacement, insurance and taxes.

V. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The principal commitment of resources is the depletion of thermal energy and water from the geothermal reservoir. Both of these resources are renewable but not within the life span of a specific project. Once they are depleted to the point where economic production cannot continue, production will stop, facilities will be removed, and the area will be restored to as nearly a natural state as is practicable. There is no foreseeable alternative use of the stored energy other than possible space heating. The associated water produced by the operation could be of significant value if it is of sufficiently good quality, either naturally or by desalination, to be used for other purposes.

Compaction and resulting land subsidence that may result from the removal of geothermal fluids can have irreparable consequences. An equivalent amount of water storage will be lost. In developed areas, substantial adjustments might be required to compensate for such subsidence. The EAR area borders developed land and in many cases is separated by irrigation canals. Subsidence in these areas could cause breaching of the canals. This would cause considerable damage to the developed land below. On the land in the EAR area, however, no adjustment will be required from such a phenomenon. If seismic action results from fluid withdrawal or reinjection, considerable damage could result, depending upon the severity of the action.

Some onsite or related ecological features such as plant life, wildlife, and aesthetics can be altered. Cuts and fills for power plant sites, production wells, roads, etc., can leave landscape scars. In some instances, roads may be retained as permanent access routes to facilitate other land uses. The extent of such alterations depends upon the individual site and the nature of development.

Dedication of the land surface to industrial uses generally will result in land areas being used for wells, associated surface facilities, power plants, roads and transmission lines. While not of a permanent nature, such uses represent a commitment for a period of 25 to 50 years. This is relatively a long period in terms of human lifetimes and related alternative uses of these lands and their other resources.

Human energy, money and construction materials are other resources irretrievably committed in the development of geothermal steam. However, to the extent that these resources represent a commitment to increased power generating capacity to meet regional or national needs, their consumption would be necessary regardless of the technology utilized in the generating process.

VI. PERSONS, GROUPS, AND GOVERNMENT AGENCIES CONSULTED:

The following local people were consulted concerning geothermal development in this area:

Dolores Echanis
President, Ontario Basque Club
Ontario, Oregon

George Iseri
Manager, Iseri Realty Agency
Ontario, Oregon

Reverend Shinryo Sawada
Ontario Buddhist Temple
Ontario, Oregon

Mary Thiel
Manager, Day Care Center for Migrant Children
Ontario, Oregon

Sola Staley
Librarian, Vale Elementary School
Vale, Oregon

Howard Ego
City Coordinator
Vale, Oregon

Robert Harrod - Supervisor
Malheur County Intermediate Education District
Vale City Mayor
Vale, Oregon

Jim Grant
Manager of Vale Office of Idaho Power Company
Vale Chamber of Commerce
Vale, Oregon

Jerry Auyer - Publisher and Editor
Malheur Enterprise
Vale, Oregon

Alford Pottoriff
Malheur County Planner
Malheur County
Vale, Oregon

Oregon Wildlife Commission
Ontario, Oregon

Roy Cook - Director
Southeast Oregon Council of Governments
Vale, Oregon

Henry Schneider
Nyssa City Manager
Nyssa, Oregon

Dirick Nedry - Publisher and Editor
Gate City Journal
Nyssa, Oregon

Don Young
President of U. S. National Bank, Nyssa Branch
Past President Nyssa Chamber of Commerce
Assistant Manager of Vale Branch of U. S. National Bank (15 years)
Nyssa, Oregon

Jake Fischer
Ex-county Commissioner of Malheur County
Nyssa, Oregon

Francis McLean - Publisher
Daily Argus Observer
Ontario, Oregon

Roy Probasco
Ontario Chamber of Commerce
Employee of KSRV Radio Station
Ontario, Oregon

Jack Collins
Ontario City Manager
Ontario, Oregon

Frank Yraguen
Malheur County District Attorney
Vale, Oregon

Bureau of Land Management personnel of the Vale District made several trips and requested assistance from several people in their quest for information about geothermal development.

Five members of the Vale BLM visited the Geyers Geothermal Development out of Ukiah, California.

Five members of the Vale BLM attended a Geothermal Seminar in Portland, Oregon, sponsored by the BLM. One member of the Vale BLM attended a Geothermal Seminar on Non-Power Uses of Geothermal Energy at Klamath Falls.

Assistance was requested from the U. S. Geological Survey concerning geothermal development. Bruce Hellier and Bill Lee of the U. S. Geological Survey and Richard Bowen of Oregon State Department of Minerals and Geology Research spent a day in the Vale office explaining geothermal development.

Two members of the Vale BLM attended a Geothermal Seminar in El Centro, California, at which several experts in the field spoke on the subject and made themselves available for questions. A tour of the Cerro Prieto geothermal development in Mexico was provided.

Three Geothermal Seminars were held in the Vale area. George Nielson of the BLM, California State Office spoke and answered questions at the seminar.

VII. INTENSITY OF PUBLIC INTEREST

The proposed geothermal development has aroused only mild public interest. This is based on the number of people that attended the three public meetings and their reaction to the explanation of geothermal development, thirteen interviews with people in the vicinity, and the number of contacts that have been made with BLM personnel concerning the proposed development.

Three public information seminars were sponsored by the BLM on March 25, 26 and 27 in Vale, Nyssa and Ontario, respectively. Sufficient advance public notice was provided through all local newspapers, radio and television. In addition, 109 personal invitations were sent out to local government entities, civic, and service groups. Attendance at the public meetings, other than BLM personnel present, was Vale - 30, Nyssa - 7, Ontario - 55. See Appendix I for list of individual entities that were sent invitations.

There was no strong reaction voiced at the meetings. Few questions were asked. Several of the questions were asked by BLM personnel with the hope of drawing more reaction from the audience. Only three questions were asked at the Nyssa meeting. A list of questions asked can be found in Appendix II.

Public contacts with BLM personnel concerning the proposed development range from none for the majority of the personnel to a moderate number for the District Manager and Chief of Resources.

A letter of inquiry was sent to 310 individuals and organizations soliciting comments on the environmental impact of geothermal leasing in the Vale area. Replies were received from 15 parties. Copies of our letter, the list of persons to whom it was sent, and the replies, can be found in Appendices III, IV and V.

VIII. PARTICIPATING STAFF

This Environmental Analysis Report was prepared in the Vale District, Bureau of Land Management by:

Thomas A. Moore - Chief, Division of Resources
Francis E. Noll - Soil and Watershed Specialist
Philip R. Rumpel - Range Management Specialist
Robert R. Kindschy - Wildlife Specialist
Sheldon E. Saxton - Realty Specialist
William A. Jordan - Realty Specialist
William C. Schneider - Recreation Specialist
Robert J. Sherve - Northern Resource Area Manager
Earl Boone - Geologist

IX. RECOMMENDATIONS ON ENVIRONMENTAL STATEMENT

Based upon the recorded analysis above, the mitigating measures discussed, and other pertinent data, an environmental impact statement is not recommended.

PREPARED BY:

Robert J. Sherve
Northern Resource Area Manager

5-9-75
Date

I CONCUR:

District Manager

5/9/75
Date

Environmental Coordinator

5/9/75
Date

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Exploration and Development of Geothermal Resources

2. Stages of implementation

Field Development

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	3. DISCRETE OPERATIONS: Drilling	Testing	Road Const.	Site Const.		6. REMARKS
	5. ANTICIPATED IMPACTS					
I. NONLIVING COMPONENTS						
A. AIR						
Particulate	-L		-L	-L		
Non-Condensable Gases	-M	-M				
B. LAND						
Soil Pollutant	-L	-L	-L	-L		
Soil Erosion	-M		-M	-M		
Geologic Structure	-L					
Land Use Compatibility	-H	-L		-H		
Land Use Suitability	-L	-L		-L		
C. WATER						
Hydrologic Cycle	-L					
Sediment Load	-M	-L	-L	-L		
Dissolved Solids	-M	-L	-L	-L		
Chemical-Toxic Substance	-M	-L	-L	-L		
Coliform Contamination	-L		-L	-L		
Acid Balance	-M	-L	-L	-L		
Dissolved Oxygen	-L		-L	-L		
II. LIVING COMPONENTS						
A. PLANTS *(Aquatic)*						

(Continued on reverse)

DISCRETE OPERATIONS

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	Drilling	Testing	Road Const.	Site Const.	REMARKS
II. LIVING COMPONENTS (Con.)					
B. PLANTS *(Terrestrial)*					
Lichens - Moss	-H		-H	-H	At the sites - roads and drill pads
Grass Forbs	-H		-H	-H	At the sites - roads and drill pads
Shrubs	-H		-H	-H	At the sites - roads and drill pads
C. ANIMALS *(Aquatic)*					
D. ANIMALS *(Terrestrial)*					
Mammals	-H	-M	-H	-H	At site
Reptiles	-H	-H	-M	-M	At site
Birds	-H	-H	-M	-H	At site
Man	-M		-M	-M	
III. INTERRELATIONSHIPS					
A. ECOLOGICAL PROCESSES					
Succession	-M		-H	-H	At site
Food Relationship	-M		-H	-H	
IV. HUMAN VALUES					
A. LANDSCAPE CHARACTER	-M		-M	-M	Natural character of the land will be altered.
B. SOCIOCULTURAL INTERESTS					
Social Welfare	-H		-M	-M	
Cultural	-M		-M	-M	-H Along Oregon Trail
Attitudes & Expectations	-H		-H	-H	
Local Regulatory	-M		-M	-M	

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however*, it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts then will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing)*.
4. *Elements Impacted* – Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.
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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action: Exploration and Development of Geothermal Resources

2. Stages of implementation: Operation

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	3. DISCRETE OPERATIONS: O & Maint.	Redrilling				5. ANTICIPATED IMPACTS	6. REMARKS
I. NONLIVING COMPONENTS							
A. AIR							
Non-Ionizing Radiation	-L						At the power plants
B. LAND							
Soil Erosion	-L	-L					
Land Compatibility	-L	-L					
C. WATER							
Sediment Load	-L						
Dissolved Solid	-L						
Hydrologic	-L						
II. LIVING COMPONENTS							
A. PLANTS *(Aquatic)*							

(Continued on reverse)

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	DISCRETE OPERATIONS: O & Maint.	Reseeding			ANTICIPATED IMPACTS	REMARKS
II. LIVING COMPONENTS (Con.)						
B. PLANTS *(Terrestrial)*					L+	Rehabilitation will be initiated.
C. ANIMALS *(Aquatic)*						
D. ANIMALS *(Terrestrial)*					L+	
III. INTERRELATIONSHIPS						
A. ECOLOGICAL PROCESSES Succession					L+	
IV. HUMAN VALUES						
A. LANDSCAPE CHARACTER						
B. SOCIOCULTURAL INTERESTS Social Welfare					-M	
Attitudes & Expectations					-M	
Local Regulatory					-M	

INSTRUCTIONS

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action: Exploration and Development of Geothermal Resources

2. Stages of implementation: Power Plant & Transmission Construction

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS: Site Preparation	Road Const.	Pipeline	Plant Const.	Transmission Const.	6. REMARKS
I. NON-LIVING COMPONENTS						
A. AIR						
Particulate Matter	-L	-L			-L	
B. LAND						
Soil Erosion	-M	-M		-L		
Land Use Compatibility	-H	-H	-L	-H	-M	
Land Use Suitability	-L	-L	-L	-L	-L	
C. WATER						
Sediment Load	-M	-M			-L	
Solid Debris	-L	-L	-L	-L	-L	
Coliform	-L	-L	-L	-L	-L	
II. LIVING COMPONENTS						
A. PLANTS *(Aquatic)*						

(Continued on reverse)

DISCRETE OPERATIONS	Site Preparat.	Road Const.	Pipeline	Plant Const.	Transmission	
COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Cont.)						
B. PLANTS *(Terrestrial)*	-H	-H	-L	-L	-L	At plant sites
C. ANIMALS *(Aquatic)*						
D. ANIMALS *(Terrestrial)*	-H	-H	-H	-H	-M	
Man	-M	-M	-L	-M	-L	
III. INTERRELATIONSHIPS						
A. ECOLOGICAL PROCESSES						
Successing	-H	-M	-H	-H	-L	
Food Relationship	-L	-L	-L	-L	-L	
IV. HUMAN VALUES						
A. LANDSCAPE CHARACTER	-M	-M	-H	-H	-M	Natural character of the land will be altered, visual impact may be high
B. SOCIOCULTURAL INTERESTS						
Cultural	-L					
Social Welfare	-H	-H	-H	-H	-H	
Attitudes & Expectations	-H	-H	-H	-H	-H	
Regulatory	-H	-H	-H	-H	-H	
Educational/Scientific	-L	-L	-L	-M	-L	Along Oregon Trail

INSTRUCTIONS

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   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.

2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.

3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing)*.

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U.S. GOVERNMENT PRINTING OFFICE 1974 — 781-866

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Exploration and Development of Geothermal Resources

2. Stages of implementation

Exploration

3. DISCRETE OPERATIONS	Topo Map	Geologic Map	Field Invest.	Geochem Survey	Geophys Survey	Temp Survey	Shallow Drilling	
4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS							6. REMARKS
I. NONLIVING COMPONENTS								
A. AIR								
Particulate Matter			-L				-L	
B. LAND								
Soil Pollutant							-L	
Soil Erosion	-L	-L	-L	-L	-L	-L	-L	
C. WATER								
Sediment Load	-L	-L	-L	-L	-L	-L	-L	
Ground Water Contamination					-L		-M	
II. LIVING COMPONENTS								
A. PLANTS (*Aquatic*)								

(Continued on reverse)

DISCRETE OPERATIONS	Topo Map	Geologic Map	Field Invest	Geochem Surve	Geophys Survey	Temp Survey	Shallow Drill	
COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	ANTICIPATED IMPACTS							REMARKS
II. LIVING COMPONENTS (Cont.)								
B. PLANTS (*Terrestrial*) Lichens Moss	-L	-L	-L	-L	-L	-L	-L	
Grass - Forbs	-L	-L	-L	-L	-L	-L	-L	
Shrubs	-L	-L	-L	-L	-L	-L	-L	
C. ANIMALS (*Aquatic*)								
D. ANIMALS (*Terrestrial*) Mammals	-L	-L	-L	-L	-L	-L	-L	
Birds	-L	-L	-L	-L	-L	-L	-L	
Reptiles	-L	-L	-L	-L	-L	-L	-L	
III. INTERRELATIONSHIPS								
A. ECOLOGICAL PROCESSES Succession							-L	At drill site
IV. HUMAN VALUES								
A. LANDSCAPE CHARACTER						-L	-L	
B. SOCIOCULTURAL INTERESTS Attitudes & Expectations							-L	
Local Regulatory							-L	

INSTRUCTIONS

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Exploration and Development of Geothermal Resources

2. Stages of implementation

Production Testing

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	3. DISCRETE OPERATIONS: Testing	5. ANTICIPATED IMPACTS	6. REMARKS
I. NONLIVING COMPONENTS			
A. AIR			
Non Condensible Gas	-L		
B. LAND			
Soil Erosion	-L		
Soil Pollution	-L		
Land Use Compatibility	-M		
Land Use Suitability	-L		
C. WATER			
Sediment Load	-L		
Dissolved Solids	-L		
Chemical Toxic Substance	-L		
Temperature	-L		
Coliform Contaminate	-L		
Acid Balance	-L		
Dissolved Oxygen	-L		
II. LIVING COMPONENTS			
A. PLANTS *(Aquatic)*			

(Continued on reverse)

	DISCRETE OPERATIONS	Testing			
	COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	ANTICIPATED IMPACTS			REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*				
	Moss - Lichens	-M			At drill sites
	Grass forbs	-M			
	Shrubs	-M			
	C. ANIMALS *(Aquatic)*				
	D. ANIMALS *(Terrestrial)*				
	Mammals	-M			At drill sites
	Birds	-H			
	Reptiles	-H			
	Man	-H			
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES				
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER	-M			
	B. SOCIOCULTURAL INTERESTS Attitudes & Expectations	-L			Noise at the site
	Local Regulatory	-L			

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Exploration and Development of Geothermal Resources

2. Stages of implementation

Test Drilling

3. DISCRETE OPERATIONS

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS: Drilling	Sample	Completion	Road Const.	Site Const.	6. REMARKS
I. NONLIVING COMPONENTS						
A. AIR						
Particulate	-M			-L	-L	
Non Condensable Gases	-M					
B. LAND						
Soil Pollutant	-L					
Soil Erosion	-M			-M	-M	
C. WATER						
Sediment Load	-M			-M	-M	
Dissolved Solids	-M	-L				
Ground Water	-M					
Solid Waste	-L			-L	-L	
Coliform	-L			-L	-L	
Surface Water	-M					
II. LIVING COMPONENTS						
A. PLANTS *(Aquatic)*						

(Continued on reverse)

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS					REMARKS
	DISCRETE OPERATIONS	Drilling	Sample	Completion	Road Const.	Site Const.	
II. LIVING COMPONENTS (Con.)	B. PLANTS (*Terrestrial*)	-H			-H	-H	At the site
	C. ANIMALS (*Aquatic*)						
	D. ANIMALS (*Terrestrial*)	-H			-H	-H	At site
	Man	-L			-L	-L	
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES						
	Succession	-H			-H	-H	At site
	Food Relationships & Community	-H			-H	-H	
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER	-L			-L	-H	
	B. SOCIOCULTURAL INTERESTS						
	Educational Scientific	-H			-H	-H	Along Oregon Trail
	Social Welfare	-L		-L	-L	-L	
	Attitudes & Expectation	-M			-M	-M	
	Local Regulatory	-M		-M	-M	-M	

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U.S. GOVERNMENT PRINTING OFFICE 1974 — 761-866

Appendix I

Invitation Letter & List of Parties to whom Letter Sent

An Invitation to Attend a BLM Sponsored Public Information Geothermal Seminar

APPENDIX I

Vale, Oregon

March 14, 1974

From now on, two important and exciting words will play a very necessary and meaningful role in our lives and those of future generations. These words are "geothermal steam", a source of energy which is present in Malheur County.

The Vale District, Bureau of Land Management, is sponsoring several geothermal information seminars for local governments and interested service organizations to provide you with some knowledge of this field and to give you an idea of what will be taking place in your area.

Meetings have been arranged as follows:

Vale	-	March 25, 1974, St. Patrick's Parish Hall, 8:00 p.m.
Nyssa	-	March 26, 1974, Library Meeting Room, 8:00 p.m.
Ontario	-	March 27, 1974, Room W-10, Weese Bldg., TVCC, 8:00 p.m.

We would appreciate having one or more representatives from your group present at the meeting in your local area. However, if this is not practical, the door will be open at any of the three meetings.

A short field trip, not more than two hours, will be held at 10:00 a.m. Thursday, March 28, to view the Vale competitive geothermal lease area. Environmental impacts will be discussed. Transportation will be provided by the federal government.

Sincerely yours,

George R. Gurr
District Manager

Malheur County National Farmer's Organization
% Watt Wilcox, President
Rt. 2
Ontario, OR 97914

Malheur County Farm Bureau
% Earnest Seuell, President
R. Rt.
Homedale, ID 83628

Oregon State Highway Department
Regional Office
LaGrande, OR 97850

Phil W. Schneider
Northwest Field Representative
National Wildlife Federation
8755 S.W. Woodside Drive
Portland, OR 97225

Big Bend Grange-Lawrence Miller
% Mrs. Judith Andregg, Secretary
Rt. 3
Parma, ID 83660

Ontario Heights Grange, Leo Fschida, Master
% Karen Rule, Secretary
Rt. 1, Box 167
Ontario, OR 97914

Willowcreek Grange, Charles Pettig
% Mrs. W. W. DeLong, Secretary
Rt. 2, Box 198
Vale, OR 97918

Arock Grange - Hazel Fretwell
% Mrs. Lucile Montgomery, Secretary
Jordan Valley, OR 97910

Oregon Environmental Council
4315 SW Corbett
Portland, OR 97201

Dairy Herd Improvement Association
% Mrs. Donna Faw
Rt. 1, Box 44
Vale, OR 97918

Malheur Dairy Wives
% Mrs. Joe Payne
Rt. 1
Vale, OR 97918

Hells Canyon 4 Wheelers
% Max Castle
Cousens Motor Company
Weiser, ID 83672

Paul C. Paulsen
Land Matters Committee
PNW 40 Wheel Dr. Assoc.
1547 Elliot Ave. S.E.
Portland, OR 97214

Ontario Lions Club
% Jimmie Clayton, President
410 E. Idaho Ave.
Ontario, OR 97914

Vale Lions Club
% Orlin Culbertson, President
Vale, OR 97918

Ontario Rotary Club
% Willis Hicks, President
1208 S.W. 11th
Ontario, OR 97914

Boise Four Wheelers
227 Lexington
Boise, ID 83706

Idaho Power Company
Vale, OR 97918

Vale Warmsprings Irrigation Dist.
318 A. Street West
Vale, OR 97918

Oregon State Division of Lands
155 Court St. South
Vale, OR 97918

Duane Town
Soil Conservation Service
Vale, OR 97918

Grady Romans, Chairman
Vale District Advisory Board
Westfall, OR 97920

Malheur County Court
Malheur County Courthouse
Vale, OR 97918

Mr. Ted Trueblood
Associate Editor
Field & Stream
719 8th Ave. S.
Nampa, ID 83651

Wildlife Management Institute
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Appendix II

Questions Asked at Geothermal Meetings

APPENDIX II

Questions asked at Geothermal
Meeting - Vale, March 25, 1974

1. Will this bring in many people?
2. Is there any jeopardy of current uses drying up?
3. What is the minimum water temperature to make economically feasible?
4. There are two different zones in area - how do we control development to alleviate future problems?
5. Does Vale have air quality control region?
6. Would this be perpetual other than maintenance?
7. Would there be initial hot water supply for heat exchanges?
8. Would brine from underground cause subsidence?
9. Would present hot water well dry up?

Questions asked at Geothermal
Meeting - Ontario, March 27, 1974

1. What did you say the average figures were on drilling an 8000 foot well? Was it $125,000?

2. I heard the Atomic Energy was going to do some of the exploration. Is this so?

3. Is BLM doing any of the development of geothermal steam?

4. For each particular lease, is there going to be a separate hearing, or is this going to be the only one?

5. Did you say it had mercury vapor in it? Isn't that dangerous?

6. How will you handle the exploration areas?

7. Will it be for a large block of acres?

8. How long before any of the proposed areas will be leased?

9. Does any of the money come back to the county? Do you know how much comes back to the county?

10. How close are we to a geothermal well in the immediate area?

11. I understand there is already private ground leased. Do you know how much?

12. Is there a time limitation on the leases?

13. Can they tie up land for an indefinite time?

14. When was the first leases issued here?

15. What happens when the gas and oil exploration area over-laps the KGRA area?

16. Hasn't there been quite a bit of oil and gas exploration around here over the years? What was the results?

Appendix III

Letter Soliciting Comment
on
Geothermal Leasing

United States Department of the Interior

IN REPLY REFER TO
3220 (030)

BUREAU OF LAND MANAGEMENT
P. O Box 700
Vale, OR 97918

Dated when issued
12/17/74 initial distribution
1/6/75 latest mailing of record

Dear Sir:

The Vale District office of the Bureau of Land Management is in the process of writing an environmental anlysis on the effect of geothermal development on the approximate area of the enclosed map. The map symbol for the Vale KGRA (Known Geothermal Resource Area) Addition" refers to the approximately 13,500 acres southeast of Vale, along Lytle Boulevard, which will be leased in the Spring of 1975. The map symbol for the "Approximate Area of Vale KGRA EAR (Environmental Analysis Report) Supplement," refers to the area that will be covered by the environmental analysis now in progress.

The enclosed "Environmental Analysis Worksheet" shows the specific aspects of the environment that will be considered in our report. If you have any comments on the effect of geothermal leasing on the environment of this area, we would appreciate your comments by February 14, 1975.

Public meetings were held prior to the lease of the 1347 acres of the original Vale Known Geothermal Resource Area in the Spring of 1974. Unless this letter generates sufficient interest and comment to justify another public meeting, the Vale KGRA Addition will be leased without such a meeting. Your comments are welcomed.

Sincerely yours,

W R. Papworth
Acting District Manager

Enclosures 2
Enclosure 1 - Map
Enclosure 2 - EAR Worksheet

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

A P P E N D I X IV

LIST OF PARTIES
WHO WERE SENT THE
LETTER OF INQUIRY FOR
COMMENT ON GEOTHERMAL LEASING
IN APPENDIX 3.

APPENDIX 4

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Natural Resources Department of
Division of Geology & Earth Resources
Olympia, WA 98504
Ted Livingston

Newscomers Club
Terrel, Mary Ann
1107 River
Payette, ID 83661

Nevada Association for Progressive Fish & Game Legislation
% Phodic, Russel D.
685 E. York Street
Sparks, NV 89431

Nevada Cattlemen's Association
143 Idaho Street, Room 216
Elko, NV 89801

Nevada Organization for Wildlife
P O Box 2469
Reno, NV 89505

Nevada Woolgrowers' Association
579 Second Street
Elko, NV 89801

Newcomers
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1036 SW 5th Avenue
Ontario, OR 97914

Nishihara, Tom
1092 S. Idaho Avenue
Ontario, OR 97914

North Board of Control
17 S. 1
Nyssa, OR 97913

O'Net V M., Jr.
Shearson Hammill
14 Wall Street
New York, NY 10005

Ontario Basque Club
Echanis, Dolores; President
Ontario, OR 97914

Ontario Heights Grange
Tschida, Leo; Master
Ontario Heights
Ontario, OR 97914

Ontario Study Club
Mrs. Bean, Lewis; President
748 SW 4th
Ontario, OR 97914

Optimists
% McKone, Ron
Ontario Heights
Ontario, OR 97914

Oregon Association of Soil &
Water Conservation Districts
Christensen, Stanely R., President
Road 1, Box 264
McMinnville, OR 97128

Oregon Cooperative Wildlife
Research Unit, USDI
Bioscience Building
Oregon State University
Corvallis, OR 97331

Oregon Environmental Council
Williams, Lawrence F.; Executive Director
2637 SW Water Avenue
Portland, OR 97201

Oregon Environmental Quality,
Department of
P. O. Box 231
Portland, OR 97205

Oregon, Geology & Minerals
Industries, Department of
Baker Field Office
2033 First Street
Baker, OR 97814

Oregon, Geology & Minerals
Industries, Department of
Corcoran, Raymond E., State Geologist
1069 State Office Building
Portland, OR 97201

Oregon, Governor of
208 State Capitol
Salem, OR 97310

Oregon Historical Society
1230 SW Park Avenue
Portland, OR 97205

Oregon, Salem
Cox, William S., Director
Division of State Lands
1445 State Street
Salem, OR 97310

Oregon State of
Division of State Lands
20 Agriculture Building
Salem, OR 97310

Oregon State Division of Lands
155 Court Street South
Vale, OR 97918

Oregon State Forestry, Department of
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Salem, OR 97310

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Route #1
Ontario, OR 97914

Oregon State Game Commission
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P. O. Box 3503
Portland, OR 97208

Oregon Statesman
City Desk
Statesman-Journal Company
Salem, OR 97301

Oregon Student Public Interest
Research Group (OSPIRG)
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408 SW 2nd Street
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Outdoor Recreation Bureau of
Pacific NW Regional Office
1000 Second Avenue
Seattle, WA 98104

Pacific NW Forest & Range Experiment
Station
P.O. Box 3141
Portland, OR 97208

Packwood, Robert W., Senator
6327 New Senate Office Building
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Park Improvement Club
Lee, Barbara (Mrs.)
Rt. #2
Ontario, OR 97914

Payette County Rodeo Board
Coble, Ray, President
Fruitland, ID 83619

Payette Merchants Committee
Blackmere, Lloyd (Mr.)
2230 Center Avenue
Payette, ID 83661

Payette Municipal Development Corp.
Kinney, Art; President
Box 159
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Payette School Board
Waine, D; Chariman
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Payette, ID 83661

Payette Shrine Club
McWilliams, Cecil (Mr.)
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Phillips Petroleum Co.
P.O. Box 752
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Pressley, George (Mayor of Vale)
Mayor of Vale
317 W. St. Street
Vale, OR 97918

Realty, Baker City
130 S.W 2nd Avenue
Ontario, OR 97914

Realty, Cunningham
301 A Street East
Vale, OR 97918

Realty, Dealy Inc.
192 SW 3rd Avenue
Ontario, OR 97914

Realty, Flying
% Johnson, Kenneth
Box 606
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Realty, Grigg & Tax Service
% Grigg, Dick
Box D
Vale, OR 97918

Realty, Parker Paul
11 S W. 3rd Avenue
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Welch, John; Realty Specialist
Boise, ID 83724

Reclamation, Bureau of
Central Snake Projects Office
214 Broadway Avenue
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Regional Studies Center
College of Idaho
Caldwell, ID 83605

Register Guard
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Forest Service, USDA, Region 6
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1252 Alemeda Drive
Ontario, OR 97914

School, Cairo Elementary
Eddy, Nick (Mr.)
Route #1
Ontario, OR 97914

School, District #1
Guyer, Ronald (Mr.)
Brogan, OR 97903

School, District #1
Shook, Alberta, Principal (Mrs.)
Jordan Valley, OR 97910

School, District #2
Mayfield, Sandra (Miss)
Rockville Route
Marsing, ID 83639

School, District # 8C
Irons, Mile (Mr.)
497 S.W. Third Avenue
Ontario, OR 97914

School, District No. 12
Weeks, Denzel (Mr.)
Juntura, OR 97911

School, District #15
Morgan, Edwin, (Dr.) Superintendent
604 Cottage Street South
Vale, OR 97918

School, District # 26
McParland, Walter L. (Mr.)
Nyssa, OR 97913

School District # 29 - Annex
Stone, Howard, J. (Mr.)
Route # 3
Weiser, ID 83672

School District # 42
Wiseman, Mel, (Mr.) Principal
Route #2
Vale, OR 97918

School District #51 -
Mr. McDermitt; Principal
McDermitt, NV 89421

School District No. 61 - Adrian
Ward, Glenn E (Mr.)
Adrian, OR 97901

School District # 66 - Harper
Waite, Mark; Superintendent
Harper, OR 97906

School District # 66 - Harper
Mr. Matthews, Les
Harper, OR 97906

School District # 81 - Arock
Dowell, Sandra (Mrs.)
Arock, OR 97902

School, Aiken, George Elementary
Patterson, Robert (Mr.)
1297 West Idaho Avenue
Ontario, OR 97914

School, Elementary
Holton, James (Mr.)
Adrian, OR 97901

School, Junior High
Martin, Dan; Principal
Nyssa, OR 97913

School, Junior High
Mr. Bates, Eugene, Principal
537 S W Second Avenue
Ontario, OR 97914

School, Lindbergh Elementary
Myron Carpenter, Principal
482 Southeast Third
Ontario, OR 97914

School, Middle
Deymonaz, Frank (Mr.)
Vale, OR 97918

School, Nyssa Elementary
Munn, Melvin; Principal
Nyssa, OR 97913

School, May Roberts Elementary
Hicks, Alvin; Principal
590 N.W. Eighth
Ontario, OR 97914

School Superintendent -
Malheur County
251 B. Street West
Malheur County Courthouse
Vale, OR 97918

School, Senior High
Chester, Gene (Mr.)
Nyssa, OR 97913

School, Senior High
Wells, Gary (Mr.)
1115 West Idaho Avenue
Ontario, OR 97914

School, Union High, District #1
Mills, Eugene (Mr.)
Jordan Valley, OR 97910

School, Union High, District # 3
Camman, Gerald; Principal
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School, Vale Elementary
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Dlay Care Center for Migrant Children
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℅ Shell, LaVerne (Mrs.)
Nyssa, OR 97913

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Lawrence, Robert
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Treasure Valley Rock & Gem Club
℅ Waggoner, John
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Vale, OR 97918

Vale-Warmsprings Irrigation District
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℅ Morse, William B.
1617 N.E. Brazee
Portland, OR 97212

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Charles Rettig, Master
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Wolf, Marvin
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Denver, CO 80201

Wolfe, Melvin
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Denver, CO 80222

Women's Civic League
Mrs. Millie Phillips
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Payette, ID 83661

Women's Club of Vale
Barkley, Walter (Mrs.)
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Woodward-Gizienski & Associates
Birkhahn, Phillip
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Yraguen, Frank
Malheur County District Attorney
Vale, OR 97918

Appendix V

Responses
to
Letter Soliciting Comment
on
Geothermal Leasing
(Appendix III)

The replies to our letter soliciting comments on environmental impact of geothermal leasing in the Vale area have been analyzed.

With few exceptions the responses fell within the framework of our environmental analysis. Few impacts were mentioned by respondents that were not covered and mitigated to the maximum in the EAR, and few impacts were mentioned by the respondents, which they felt were of greater concern than what we assigned to them in the analysis.

The exceptions are:

1. The beneficial impacts of geothermal development. We did not go into detail about the beneficial economic impacts on the people of the county. The detail to which one respondent suggested is beyond the realm of this environmental analysis.

2. Nothing is known (in this office) about the existence, distribution, etc., of the proposed rare or endangered plants, therefore, they are not taken into consideration in the analysis. The proposed geothermal action is not expected to have any significant detrimental or beneficial affect on these plants if they do occur within the analysis area.

A common indication from the respondents and a problem of soliciting comments on a proposed action of this nature and magnitude is a lack of knowledge, on the respondent's part, of the entire process with related problems and mitigating measures.

JAN 22 1975

To: EAR data - Vale KGRA

From: Vale District Wildlife Biologist

Subject: Rare Flora

Mrs. A. C. Siddall, Chairman, Oregon Chapter of The Nature Conservancy, contacted us by letter of January 14, 1975, to comment on the occurance of four species of plants which might occur within the KGRA.

On January 22, 1975, I contacted Ila Mae Johnston, Assistant Curator of the Oregon State University Herbarium, Corvallis, with regard to the status of these plant species. She provided the following information:

Astragalus mudisiliquus occurs along the Snake River valley and associated valleys. The 13,000 acres within the Vale KGRA would not constitute a significant portion of its distribution.

Cryptantha propria, Eriogonum ochrocephalum ssp. calcareum, and Hackelia patens are all plants associated with the Miocene sediments of Ancient Lake Payette - especially the outcroppings of the Harper/Westfall area. Because this formation is not exposed within the Vale KGRA it is not likely that these species occur within it.

Robert R. Kimsey

A5-2

JAN 22 1975

JAMES T. FLANAGAN, M. D.
PHYSICIAN
DIAGNOSIS AND INTERNAL MEDICINE
915 S. W. THIRD AVE.
ONTARIO, OREGON

11 February 1974

George Gurr
Route 2, Box 33A
Vale, Oregon

Dear George:

In our discussion of exploration for geothermal sites in Malheur County, you seemed to imply that we needed industries and industrial growth in Malheur County. I think the charm of this area is the fact that it is not polluted and overpopulated and despoiled by industrial growth and it is the reason that so many of us came to this area from cities and industrialized areas. While it is quite typical of the usual American drive to want to industrialize an area and create jobs and bring in money as well as the myriad of problems that follow industrialization, I think it is wise to leave a few areas in the United States that are not this way and that are relatively unspoiled. If we have a rapid influx in population, certainly our hunting and fishing as we know it will disappear, just as it has in the East.

I think we have a good thing and I would like to see us keep it that way and I hope that the geothermal exploration doesn't pan out any better than the gas and oil exploration has over the past 50 years in this area. Heavens knows that if a person wants industrialization and population density, there are plenty of places in the United States he can go and find it; whereas, finding some of the decent places to live where pollution is just moderate, is a problem and this is one of the few relatively unspoiled areas left.

I am sure the Chamber of Commerce in Vale feels differently about this, as do many businessmen because it is the hallmark of our culture to seek the almighty dollar and to try to make as much money as possible and to be as busy as possible and these are the same people who are insisting that hunters come to this area and fishermen come to this area, while the landowners are crying, "No! No!"

When the weather gets good and one can travel about, I certainly would appreciate your giving me a call and seeing if we can arrange to see some of the areas in Malheur County that I haven't visited. I think it would be an exciting venture.

Sincerely,

James T. Flanagan, M. D.

JTF/csa

A 5-3

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
NORTHWEST REGION
~~1000 SECOND AVENUE~~
~~SEATTLE, WASHINGTON 98104~~
915 SECOND AVE., ROOM 990
SEATTLE, WASHINGTON 98174

JAN 6 1975

IN REPLY REFER TO:
E3435

DEC 31 1974

Memorandum

To: Acting District Manager, Bureau of Land Management, Vale, Oregon

From: Regional Director, Northwest Region, Bureau of Outdoor Recreation

Subject: Vale KGRA Addition Environmental Assessment

As indicated on the attached map, the proposed project area is traversed by the route of the Oregon Trail. A 5-mile segment of the route found to have high potential for public recreation during this Bureau's recent study (Lytle Pass Segment) lies almost entirely within the project area. The segment includes approximately 2.2 miles of discontinuous, visible Oregon Trail ruts. Four historic sites are located just outside the project area in and near Vale.

Portions of map and narrative supplements to the Bureau's study report, covering the project area, are included for reference. Both the report and supplemental materials are in the draft review stage and are subject to change. To protect potentially vulnerable historic remnants and artifacts, exact locations of historic sites and route segments should not appear in the report unless suitable protective measures are at hand. Your District Office participated in the study and should have a copy of the draft report.

The environmental analysis should include a discussion of the Oregon Trail in the project area, probable impacts on historic remnants, public recreation potentials, and mitigation measures.

Maurice H. Lundy
Regional Director
by Richard L Winters

Enclosures

A5-4

DEC 26 1974

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

BAKER FIELD OFFICE

2033 FIRST STREET • BAKER, OREGON • 97814 • Phone (503) 523-3133

TOM McCALL
GOVERNOR

December 23, 1974

Mr. W. R. Papworth
Acting District Manager
Bureau of Land Management
P. O. Box 700
Vale, Oregon 97918

Dear Mr. Papworth:

Thank you for your letter of December 17, 1974 requesting comments on the environmental analysis of the Vale KGRA. I am enclosing the environmental analysis work sheet with my comments. I feel that the significant impact will occur only after substantial geothermal resources are discovered and proven by deep drilling. Impact during the initial stages of geophysical surveys and shallow drilling for temperature gradient information will be negligible. The major ultimate impact will likely be of an economic nature and result from development of any geothermal resources discovered during the exploration effort that may result from the proposed leasing.

Please let us know if we can be of further help. Best wishes for the Christmas season.

Sincerely,

Donald A. Hull

DONALD A. HULL

DAH/a
enc.

A5-5

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Geothermal Leasing - Vale KGRA Addition

2. Stages of implementation

	3. DISCRETE OPERATIONS →	Geophysical Surveys	Shallow drill holes for temperature gradient	Deep drilling	Power plant development	Industrial plant development	
	4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS					6. REMARKS
I. NONLIVING COMPONENTS	A. AIR	X	X	X	L	L	
	B. LAND	X	X	X	L	L	
	C. WATER	X	X	X	L	L	
II. LIVING COMPONENTS	A. PLANTS *(Aquatic)*	X	X	X	X	X	

DISCRETE OPERATIONS

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	Anticipated Impacts: Beneficial or Adverse	Anticipated Impacts: Direct or Indirect	Anticipated Impacts: Short-Term or Long-Term	Anticipated Impacts: Reversible or Irreversible	Anticipated Impacts: Mitigation Required	REMARKS
II. LIVING COMPONENTS (Cont.)						
B. PLANTS (*Terrestrial*)	X	X	X	L	L	
C. ANIMALS (*Aquatic*)	X	X	X	L	L	
D. ANIMALS (*Terrestrial*)	X	X	X	M	M	
III. INTERRELATIONSHIPS						
A. ECOLOGICAL PROCESSES	X	X	X	L	L	
IV. HUMAN VALUES						
A. LANDSCAPE CHARACTER	X	X	X	L	L	
B. SOCIOCULTURAL INTERESTS	X	X	X	M	M	Successful development of geothermal resources for either electric power generation or industrial process heat both will result primarily in a positive economic impact for the whole of Malheur County. Environmental impact, to be negligible thru the drilling stage and minimal and very localized if later development results.

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; however, it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis (e.g. *estimated time periods, season of year, etc.*).
2. *Stages of Implementation* – Identify different phases of proposed project (*e.g. a road project consists of survey, construction, use, and maintenance stages*).
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation (*e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing*).
4. *Elements Impacted* – Enter under appropriate heading environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the

AS-6A

5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Precede each entry by a plus (+) or minus (–) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* proceed with a sign. For example, construction of a wind mill on open range has a definite visual impact; *however*, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (–) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact (*e.g. low, medium, and high*) are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elements may ...ly accurate measurement or in-depth analysis with current Bureau capabilities or expertise. The nature ... the action as well as type and degree of impact should guide in the decision to seek outside expertise ... assistance.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
~~BUREAU OF SPORT FISHERIES AND WILDLIFE~~

1500 N. E. IRVING STREET
P. O. BOX 3737
PORTLAND, OREGON 97208

Reference: RB

January 9, 1975

To: District Manager, Bureau of Land Management, Vale, Oregon

From: Acting Regional Director, FWS, Portland, Oregon

Subject: Vale KGRA Addition (Mr. Papworth's letter of December 17, 1974)

We agree with the conclusions outlined in the environmental analysis report (EAR), prepared for the Vale Known Geothermal Resource Area (KGRA), that certain unavoidable changes in fish and wildlife habitat will occur from geothermal exploration and development in this area. These changes may be expected to eliminate those species intolerant of human activities and to reduce the occurrence of many other species by conversion of open desert habitat to industrial land. We believe, however, that no fish or wildlife species, habitat, or activity is considered to be a critical component of the environment, when the components involved in this KGRA are compared to the total components available.

The proposed Vale KGRA addition expands the acreage originally recommended for lease. Approximately 13,500 acres of this addition is south of the original KGRA extending into the uninhabited desert area between the Owyhee and Malheur Rivers. This addition will therefore expand industrial conversion of open desert area. Unavoidable and potential impacts on fish and wildlife will be similar to those discussed in the EAR for the original Vale KGRA. Additional impacts to fish will probably be minimal; however, impacts to wildlife will increase in proportion to the area developed.

We believe that exploratory activites in the Vale KGRA Addition will have no significant impact on fish and wildlife, their habitat, or their activities, provided that exploration does not involve, intentionally or accidentally, progressive deterioration of the environment. Loss mitigation measures outlined in section B of the EAR, under Analysis of Proposed Action, should be extended to apply to the Vale Addition to minimize the possibility of deterioration.

Geothermal development, on the other hand, involves many activities about which we have little information. Water, air, or land disturbances resulting directly or indirectly from development operations may be pronounced. Furthermore, the continual presence of man will permanently change many aspects of the environment. We reserve judgment on the significance of those potential impacts until we have more information on the extent and nature of developmental activities. We would, however, oppose any operations that would encroach further south into the desert area between the Malheur and Owyhee Rivers.

We appreciate the opportunity to comment on the proposed addition to the Vale KGRA.

Donald J. Hamilla

DONALD J. HAMILLA

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

ADMINISTRATIVE OFFICE

1069 STATE OFFICE BLDG. • PORTLAND, OREGON • 97201 • Ph. (503) 229-5580

TOM McCALL
GOVERNOR

December 30, 1974

JAN 3 1975

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Vale, Oregon

Mr. W. R. Papworth
Acting District Manager
U.S. Bureau of Land Management
P.O. Box 700
Vale, Oregon 97918

Dear Mr. Papworth:

This is in response to your letter of December 17 regarding an environmental analysis of the addition to the Vale KGRA.

I have not used the Environmental Analysis Worksheet that you sent along as I don't believe it is adequate to make an assessment of the real effects of developing a geothermal field in the Vale area. In addition to the adverse effects there should be more room to consider the beneficial impacts expected from geothermal development. One of the first considerations is how much employment can be expected from the various stages of exploration and development; and with a successful operation, how much royalty and tax payments can be expected to flow in Malheur County? From the point of view of the State of Oregon, how much other fuels, both fossil and nuclear, would be displaced through the successful development of electric power production facilities at Vale; or if the geothermal fluid were used for direct use in, say, the food processing industry, how much natural gas would this displace? By developing a geothermal field in the Vale area, how much coal will not have to be mined in Montana, and how much uranium will not have to be mined in New Mexico? How many dollars a year of foreign exchange will a 500-megawatt geothermal development save if you don't fire the boilers with oil.

These are real effects on the environment of Malheur County, Oregon and the United States that have to be considered and balanced against the potential environmental insults that are projected by some to arise from geothermal development. When you consider alternatives to leasing

the Vale KGRA, whether by nuclear or fossil-fuel fired plants, you have to consider not just the power plant but the entire cycle, and just because the mine or disposal site is somewhere else it cannot be ignored.

I hope your environmental assessment is more than just a listing of imagined or projected environmental insults but is truly a weighing of the need to develop alternative power sources against projected environmental insults, the benefit to Oregon and the West by having indigenous energy supplies, and the benefits to Malheur County in the form of jobs, income, and tax revenue. Also, there should be serious consideration of optional uses for the geothermal fluids in the event they are not of sufficient temperature for electric power production. I believe it is the obligation of the Federal government, as the principal landowner in the area, to see that in addition to protecting the surface values, the subsurface values are fully appraised and utilized to their maximum benefit.

Sincerely yours,

R. G. Bowen
Economic Geologist

RGB:lk

SOUTHEAST OREGON
COUNCIL OF GOVERNMENTS

Burns City Hall
Burns, Oregon 97720
Telephone 503 573-7550
DON OLDEMEYER
CHAIRMAN

Vale City Hall
Vale, Oregon 97918
Telephone 503 473-3252
WILLIAM JENNINGS
VICE-CHAIRMAN

December 27, 1974

Vale District Office
Bureau of Land Management
P.O. Box 700
Vale, Oregon 97918

REF: Environmental Analysis of Geothermal Leasing in Vale

Gentlemen:

Our office is currently putting a repository of information together for public use. We would appreciate a copy of the Environmental Analysis of Geothermal Leasing in Vale when it is available.

A question has been raised on Geothermal resources; "How, specifically, is a Geothermal resource classified (I.E., is it a mineral, oil, or what) and the amount, if any, of this resource that is rightfully owned by the public, in royalties?"

I hope your staff can assist us with the above question.

Sincerely,

Dale Hile

Dale Hile
Planner

P.S. What consideration is given to subsidence following withdrawl of Geothermal Resources?

DLH/alr

A5-11

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
1218 S. W. Washington Street, Portland, Oregon 97205

January 15, 1975

Mr. W. R. Papworth
Acting District Manager
Bureau of Land Management
Box 700
Vale, Oregon 97918

Dear Mr. Papworth:

We have reviewed your proposed Vale KGRA Addition lease and the attached Environmental Analysis Worksheet.

The worksheet should provide an indication of the significant impacts on the human environment.

Before we could offer any opinion as to what the impacts would be, we would need to have more details as to the present environment, what actions are proposed, and what, if any, mitigating measures are planned.

Sincerely yours,

Kenneth L. Miller, Acting
James W. Mitchell
State Conservationist

Attachment

A5-12

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

Leasing the land & drilling

2. Stages of implementation

Total project from start to completion.

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	3. DISCRETE OPERATIONS: roads	drilling	powerline	cattleguards	land use	transportation	5. ANTICIPATED IMPACTS	6. REMARKS
I. NONLIVING COMPONENTS								
A. AIR	D	-L	O	O	-L			Impact on air should be very little
B. LAND	-M	X	-M	-L	-L			Upon completion of project return land to original condition as nearly as possible.
C. WATER	X	O	O	O	O			
II. LIVING COMPONENTS								
A. PLANTS (*Aquatic*)	O	O	O	O	O			

DISCRETE OPERATIONS

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		ANTICIPATED IMPACTS: roads	drilling	powerline co	Cattle gua	travel & tra	REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*	-M	X	-L	-L	O	Restore as nearly as possible original vegetation
	C. ANIMALS *(Aquatic)*	O	O	O	O	O	
	D. ANIMALS *(Terrestrial)*	-L	-L	-L	-L	-L	
III. INTERRE-LATIONSHIPS	A. ECOLOGICAL PROCESSES	-L	X	-L	-L	-L	
IV. HUMAN VALUES	A. LANDSCAPE CHARACTER	-M	X	-M	O	-L	
	B. SOCIOCULTURAL INTERESTS						+M total impact of completed project

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however,* it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.).*

2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages).*

3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing).*

4. *Elements Impacted* – Enter under appropriate headir environmental elements susceptible to impact from a and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791.

5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Preceed each entry by a plus (+) or minus (-) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* preceed with a sign. For example, construction of a wind mill on open range has a definite visual impact; *however,* to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (-) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis with current Bureau capabilities or expertise. The nature the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.

AS-13A

FISH
COMMISSION

OFFICE OF THE DIRECTOR

307 STATE OFFICE BLDG. • 1400 S.W. 5th AVE. • PORTLAND, OREGON • 97201

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GOVERNOR

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THOMAS E. KRUSE
State Fisheries Director

DEC 30 1974

December 24, 1974

Mr. W. R. Papworth
U. S. Department of the Interior
Bureau of Land Management
P. O. Box 700
Vale, Oregon 97918

re: 3220(030)

Dear Mr. Papworth:

We have reviewed your December 17, 1974 request for comment on a proposed "Vale KGRA Addition." Our basic concerns in a lease of this scale are the protection of water quality in watercourses within and issuing from the lease area.

It is our understanding that the Wildlife Commission is working with your office to consider impacts of the proposal. As conduct of the drilling is regualted by state and federal law, protective measures are required which will protect water quality and fish life in involved watersheds.

We will defer detailed comment to the Oregon Wildlife Commission.

Sincerely,

Irving W. Jones

IRVING W. JONES
AQUATIC BIOLOGIST

cc Oregon Dept. Geology
Oregon Wildlife Commission

A5-14

Earl

The Vale Chamber of Commerce submits the following comments

1. That leasing and subsequent development be handled in such a manner so as to not diminish the value of proposed Oregon Trail developments

2. They welcome the orderly development of land in the Vale area — as long as the Environmental Quality is maintained

Baugh
V.P.
Vale CoC

OREGON STATE HIGHWAY DIVISION

P. O. Box 850
La Grande, Oregon

Telephone 963-3177

TOM McCALL
GOVERNOR

F. B. KLABOE
Administrator of Highways

January 8, 1975

JAN 9 1975

W. R. Papworth
Acting District Manager
Bureau of Land Management
P. O. Box 700
Vale, Oregon 97918

Dear Mr. Papworth:

Thank you for the opportunity to respond to BLM's plans for an environmental analysis in the Vale KGRA. I believe our comments would be most appropriately addressed under Section IV B. (Socio-cultural Interests) of your Environmental Analysis Worksheet. The State Highway Division is of course concerned with long-term transportation needs as well as providing a current safe and efficient system. The following questions reflect these considerations in terms of hydrothermal development in the Vale area.

1. Would hydrothermal exploration and development generate a need for additional highways, access routes or improvements?

2. Would the development and operation of hydrothermal facilities require placing utilities across the State highway system?

These two basic questions would seem to be pertinent to any hydrothermal development plan in the Vale area. Please contact this office if we can be of further assistance.

Sincerely,

W. E. Schwartz
Regional Engineer

By

James B. Kennedy
Regional Environmentalist

AS-16

JBK:je

United States Department of the Interior
BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGIONAL OFFICE
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043 - 550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY
REFER TO: 426
602.

JAN 1975

Memorandum

To: District Manager, Bureau of Land Management,
P.O. Box 700, Vale, Oregon 97818

From: Acting Regional Director, Bureau of Reclamation, Boise, Idaho

Subject: Environmental Analysis on Geothermal Development
of Vale KGRA Addition

The Bureau of Reclamation has no special comments or recommendations to make concerning the environmental analysis your office is making on the effect of geothermal development of the Vale KGRA (Known Geothermal Resource Area) Addition.

This report is furnished in response to your letter dated December 17, 1974.

J. Norman T. Moore

JAN 10 1975

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

AS-17

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Wallowa-Whitman National Forest
P.O. Box 907, Baker, Oregon 97814

JAN 9 1975

2820
January 8, 1975

U. S. Department of the Interior
Bureau of Land Management
P.O. Box 700
Vale, Oregon 97918

Gentlemen:

The Wallowa-Whitman National Forest has been asked to comment on your Vale KGRA EAR Supplement for Region 6 of the U. S. Forest Service. The only effect that we see that would result from the leasing of the 13,500 acres in the spring of 1975 is the distribution system for the power generated should the Vale KGRA go into production.

We have been told to expect that if a major geothermal field is developed, probably two 500 KV powerlines to distribution centers would be necessary. The possibilities of interties into the distribution system must also be considered.

The probability that these high voltage lines and interties would cross National Forest lands is high. Before commenting on your KGRA EAR Supplement we are requesting information from BPA as to the probable location of lines so that we will know what effect they will have on National Forest Adminstration. For this reason it is impossible that our comments on the EAR Supplement will reach you by the requested January 15, 1975 date. As soon as we receive information on the distribution system we will forward our comments to you.

If you have any information relative to the power distrubtion system that is pertinent to the Forest Service we would appreciate hearing from you. If you wish to telephone this information to us, please call Ken Johnson, Baker 523-6391, extension 257.

Sincerely yours,

S. P. HANNA
Acting Forest Supervisor

THE NATURE CONSERVANCY — OREGON CHAPTER

RECEIVED
JAN 20 1975

January 14, 1975

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Vale, Oregon

Mr. W.R. Papworth
Acting District Manager
Bureau of Land Management
P.O. Box 700
Vale, Oregon, 97918

Dear Mr. Papworth:

Thank you for your letter of January 6 asking for comments on the effect of geothermal leasing on the area south of Vale, the Vale KGRA. I would like to respond not only as the Chairman of the Oregon Chapter of The Nature Conservancy, but also as a participant in the PNW Research Natural Area Committee.

My remarks are directed toward: II. Living Components
B. Plants (Terrestrial)

For the past year I have been working with the RNA Committee to compile a list of the rare and endangered plants in Oregon. On the basis of information gathered to date, there are several species of plants which are known only from the area around Vale. The state of this art is too new to say at this time these species are "rare" or "endangered", designations which can only be made by the Secretary of the Interior anyway, and the specific site information too incomplete to say they are within the Vale KGRA, but should they prove to be "rare" or "endangered" and within the KGRA, they should be a part of your environmental analysis.

These species include:

Cryptantha propria (Idaho oreocarya) - Dry hillsides, n. Malheur Co. to w. Ida. Type locality is near the Harper Ranch.

Astragalus nudisiliquus (Bald-pod milk vetch) - Dry hills, n.e. Malheur Co to Elmore Co. Ida.

Eriogonum ochrocephalum, ssp. calcareum (Ochre eriogonum) - In deep deposits of loose white volcanic ash, north of Harper.

Hackelia patens (Borage family) - Occurs in limited area between Vale and Harper

In compiling the potentially rare plants list, three areas in the Owyhee Uplands province are emerging as botanically important: Sucker Creek, Owyhee River and the area around Vale. I will include the list of "plants of special interest", i.e. potentially rare or endangered, for the province. I would greatly appreciate any information you might have about any of them.

Sincerely yours,

Mrs. A.C. Siddall
Chairman, Oregon Chapter
535 Atwater Road
Lake Oswego, Oregon 97034

A5-19

Owyhee Upland Province, Oregon

Species	Distribution
Artemisia sp. (undescribed)	Basalt cliffs, 3-forks, Owyhee River, Malheur Co.
Astragalus iodanthus, var. vinereus	Bluffs, eastern Malheur Co.
Astragalus mulfordiae	Dry sandy ground, lower Owyhee River, e.Malheur C
Astragalus nudisiliquus	Gravelly bluffs, n.e. Malheur Co
Astragalus purshii, var. ophiolenes	Sagebrush desert, Owyhee River, Malheur Co.
Astragalus solitarius	Usually in sagebrush, Owyhee River, Malheur Co.
Astragalus sterilis	Clay hills, Sucker Creek, Malheur Co.
Cryptantha propria	Dry hillsides, n. Malheur Co.
Cymopterus corrugatus	Dry hills, s. Malheur Co
Eriogonum novonudum	Stony clay hills, e. Malheur Co.
Eriogonum ochrocephalum ssp. calcareum	In loose, white volcanic ash; Malheur Co.
Hackelia ophiobia	Cliffs, 3-forks of Owyhee River, Malheur Co.
Hackelia patens	Between Vale and Harper, Malheur Co.
Mentzelia mollis	Clay slopes, e. Malheur Co.
Mirabilis bigelovii	Canyon of Owyhee River, Malheur Co.
Trifolium owyheense	Dry slopes, Sucker Creek, Malheur Co.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Wallowa-Whitman National Forest
P.O. Box 907, Baker, Oregon 97814

2820
Vale KGRA Addition
January 16, 1975

U. S. Department of the Interior
Bureau of Land Management
P. O. Box 700
Vale, Oregon 97918

Dear Sir:

Information supplied to us by Ed Weitzel of the Bonneville Power Administration in Portland is that there are not any transmission lines near the Vale KGRA for distribution of the power generated if a geothermal field is developed. If the field is a producer it is reasonable to expect production of 1,000 megawatts of power. Distribution of this production would require a 500 KV line. To be a firm power source two 500 KV lines would be necessary.

There are two directions that the power could go. One is to go north and west to tie into the BPA's McNary pool. The other is to go south and tie into the proposed Jim Bridiger system that is to tie from American Falls, Idaho to Malin and Medford, Oregon and then into the BPA system.

The northern route would cross the Umatilla and Wallowa-Whitman National Forest between La Grande and Pendleton. This route would probably parallel existing power lines. The utility corridor across the Blue Mountains is rapidly becoming saturated. ITA (Artic) has a proposal under consideration to the Federal Power Commission for a natural gas pipeline through the same area. Each additional transmission line across the Blue Mountain compounds our visual resource management problems.

We are rapidly approaching the need for a utility corridor plan to plan for rights-of-way needed for transmission of energy over the Blue Mountains. The existing transmission faciliteis closely parallel I-80N, a heavily used freeway.

We recogognize that an FPC license for production and distribution of electricity is several years away, and that we will have an opportunity to comment on proposed transmission lines in the future. However, these usually come, as your request for input, with a minimum of time to provide information. For this reason we will be vitally interested in

AS-21

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progress in the development of the Vale KRGA. Should production quantities of geothermal energy develop, we will become more keenly aware of the possible effects on the National Forest in the Pacific Northwest Region of the Forest Service.

The possible tie in with the Jim Bridiger coal fields proposed transmission line between American Falls, Malin and Medford would cross the Fremont National Forest. The Fremont National Forest has a representative on the EIS team that is studying the PP&L proposed routes across Oregon. The completion date for the EIS is July 1, 1975. Recommendations from this EIS will be considered in any FPC license for production and distribution of electricity from the Vale KGRA.

The transmission lines also will affect timber producing lands. Where transmission lines cross gentle terrain such as that over the Blue Mountains and the Fremont National Forest all saw log trees must be removed from the right-of-way. The National Forests are realizing an ever shrinking land base for timber production. Hopefully, future lines can be located across open grazing lands that are only slighly impacted by the presence of power lines.

A positive impact of powerlines is that if they are properly located they can be utilized as fuel breaks for fire suppression. Although this may increase construction costs for the transmission line, when combined with Forest Service objectives, it will cause the least impact on the land and resource.

In summary, the Forest Service's concern is the visual resource management impact and loss of timber producing lands resulting from location of transmission lands on the National Forests. If the lease results in a producing field we will become increasingly concerned about possible effects a distribution system might have on National Forest lands. This may require that we prepare a Utility Corridor Plan.

We would appreciate a copy of the EAR when it is completed.

Sincerely yours,

KENNETH R. JOHNSON
Acting Lands Staff

MEMO

OREGON STATE GAME COMMISSION

To: Bob Kindschy Date: January 7, 1975

From: Vic Masson

Subject: Vale KGRA Addition

Cecil filled out a copy of your Environmental Analysis work sheet with some of his comments. This was sent to our Portland office as a basis for their reply to the form letter regarding the KGRA addition. A copy is attached for your information in case you wish to check with Cece on any particular detail.

WVM:n

Malheur County

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

2. Stages of implementation

3. DISCRETE OPERATIONS	Investigation & Development	Production				6. REMARKS
4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS					
I. NONLIVING COMPONENTS						
A. AIR						
B. LAND						
Erosion	-L	-M	-M			Any soil disturbance will cause wind & water erosion as soil is light in most cases
C. WATER						Not much Live Water in the area
II. LIVING COMPONENTS						
A. PLANTS (Aquatic)						Not applicable only in very small localized areas

DISCRETE OPERATIONS

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	Transportation	Development	Production	ANTICIPATED IMPACTS	REMARKS
II. LIVING COMPONENTS (Con.)					
B. PLANTS (Terrestrial)					
Sagebrush	X	-L	-L		Ground cover of all types would be removed in the process of building roads & development of any sites.
Grass and Other Ground Cover	X	-M	-M		
C. ANIMALS (Aquatic)					Possibly a few muskrat in drain & irrigation ditches which are very limited within the area.
D. ANIMALS (Terrestrial)					
Antelope	-L	-H	-H		Have about 50-70 Head of Antelope using area envolved
Deer	-L	-M	-H		Some deer in portions envolved
Coyote	-L	-M	-H		Quite a few coyote in area envolved
Chukar & Quail	-L	-H	-H		populations confined to localized areas, but could be quite detrimental
Pheasants	X	-L	-L		Pheasants envolved is only small portion of area.
III. INTERRELATIONSHIPS					
A. ECOLOGICAL PROCESSES					would be generally detrimental to all ecological processes and also to the landscape character as the "NATURAL Look" definitely would be done away with if the area was developed and or production of geothermal resources were made available.
IV. HUMAN VALUES					
A. LANDSCAPE CHARACTER					
B. SOCIOCULTURAL INTERESTS					

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action, however, it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts then will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis (e.g. *estimated time periods, season of year, etc.*).
2. *Stages of Implementation* – Identify different phases of proposed project (e.g. *a road project consists of survey, construction, use, and maintenance stages*).
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation (e.g. *the construction stage of the road project has the discrete operations of clearing, grading, and surfacing*).
4. *Elements Impacted* – Enter under appropriate heading, environmental elements susceptible to impact from action [illegible]. Relevant elements not considered in the [illegible]

A5-24A

5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Precede each entry by a plus (+) or minus (-) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* proceed with a sign. For example, construction of a wind mill in open range has a definite visual impact; *however*, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (-) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact (*e.g. low, medium, and high*) are relative and their meaning may vary slightly from action to action. The term "low" should not be applied to impacts of a negligable nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a "low" rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.

   It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside assistance in obtaining

WILDLIFE COMMISSION

OFFICE OF THE DIRECTOR

P.O. BOX 3503 • 1634 S.W. ALDER ST. • PORTLAND, OREGON • 97208 • Ph. 229-5551

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JOHN W. McKEAN
Wildlife Director

JAN 10 1975

January 8, 1975

Mr. W. R. Papworth
U. S. Department of the Interior
Bureau of Land Management
P. O. Box 700
Vale, Oregon 97918

Dear Mr. Papworth:

Enclosed are comments pertaining to the environmental impact of leasing 13,500 acres near Vale for geothermal exploration and potential development.

The impact on aquatic resources is expected to be minimal provided contaminated water from exploration and development activity is not allowed to reach Willow Creek or the Malheur River.

Impacts to wildlife and other natural resources is summarized on the enclosed "Environmental Analysis Worksheet."

As we have indicated in previous statements, it doesn't appear that geothermal exploration poses a significant threat to fish and wildlife with the exception of disturbance caused by access road construction. However, we are concerned with the potential impacts from actual development and operation of geothermal power plants.

The degree of impact on fish and wildlife will depend on various factors including, but not limited to, location and magnitude of production facilities, water use, transmission facilities required and associated industrial and residential development. We will be in a better position to provide specific comments once a power plant is planned for construction.

The opportunity to provide comments is appreciated.

Sincerely,

Ted Fies

Ted Fies, Aquatic Biologist
Environmental Management Section

Enc.

As-25

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

2. Stages of implementation

3. DISCRETE OPERATIONS: Exploration / Development / Production

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS					6. REMARKS
I. NONLIVING COMPONENTS						
A. AIR						
B. LAND						
Erosion	L	M	M			Any soil disturbance will lead to wind and water erosion because most soils in this area are sandy and light.
C. WATER	X	X	X			Very little live water in the lease area.
II. LIVING COMPONENTS						
A. PLANTS (*Aquatic*)	X	X	X			Only applicable in very localized areas.

DISCRETE OPERATIONS

COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	Exploration	Development	Production	REMARKS
II. LIVING COMPONENTS (Con.)				
B. PLANTS (*Terrestrial*)				
Sagebrush	X	-L	-L	Ground cover of all types would be removed in the process of building roads or development of plant sit
Grass and other ground cover	X	-M	-M	
C. ANIMALS (*Aquatic*)	X	X	X	Drainage and irrigation ditch within the lease area are inhabited by muskrat.
D. ANIMALS (*Terrestrial*)				Between 50-70 antelope currently use the lease area.
Antelope	-L	-M	-M	
Mule Deer	-L	-M	-M	A few deer inhabit the area
Coyote	-L	-M	-M	Moderate numbers present in
Chukar Partridge & Quail	-L	-M	-M	Populations confined: development c
Pheasant	X	-L	-L	Inhabit only a small portion o lease area.
III. INTERRELATIONSHIPS				
A. ECOLOGICAL PROCESSES	-L	-M	-M	Vegetation removal, soil distu water use & possible contamina possible air contamination wo all disrupt natural processe.
IV. HUMAN VALUES				
A. LANDSCAPE CHARACTER	-L	-M	-M	Natural character of land would be considerably alter if actual facilities are constructed. Visual impact would be high.
B. SOCIOCULTURAL INTERESTS				

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze "*Anticipated Impacts*" of action; however, it may be used to analyze "*Residual Impacts.*" Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis (e.g. *estimated time periods, season of year, etc.*).
2. *Stages of Implementation* – Identify different phases of proposed project (e.g. *a road project consists of survey, construction, use, and maintenance stages*).
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation (*e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing*).
4. *Elements Impacted* – Enter under appropriate he environmental elements susceptable to impact by and alternatives. Relate elements not evaluate
5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligible (X). Preceed each entry by a plus (+) or minus (-) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, do not preceed with a sign. For example, construction of a sand mill on open range has a definite visual impact; however to some people the effect is detrimental while to others it is an improvement. Do not entering a plus (+) or minus (-) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact (*e.g. low, medium, and high*) are relative and their meaning may vary slightly from action to action. The term "low" should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a purposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a "low" rating. In cases like this, the impact will usually be marked "O" or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the actions as well as type and degree of impact should weigh in the decision to seek outside expertise or services.

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

USGS – KGRA Determination:

GEOTHERMAL RESOURCES LEASE

☐ Competitive ☐ Noncompetitive

In consideration of the terms and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and

(hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001–1025) (hereinafter called "the Act") to be effective on (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements of (a) all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT – The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, (hereinafter called "geothermal resources"), in or under the following described lands situated within the County of , State of :

National Resource Lands				Acquired Lands			
T.	; R.	;	Meridian	T.	; R.	;	Meridian
Total Area				Total Area			

Containing acres (hereinafter called the "leased area" or "leased lands"), together with:

(a) The nonexclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate, and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plants, transmission lines, industrial facilities, electric, telegraph or telephone lines, and such other works and structures and to use as much of the surface of the land as may be necessary or reasonably convenient for the production, utilization, and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *provided that*, although the use of the leased area for an electric power generating plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey (hereinafter called "Supervisor"); and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended, and supplemented (30 U.S.C. 181–287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351–359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leasable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam: *Provided that*, an application is made therefor prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The Lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21–54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the Lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty-year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced on the leased lands or under an approved plan or agreement on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but not for more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES

(a) *Annual Rental* – For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased lands, the Lessee shall pay to the Lessor on or before the anniversary date of the lease a rental of $ per acre or fraction thereof.

(b) *Escalating Rental* – Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year plus an additional sum of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (10) years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any minimum royalties are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of $ per acre or fraction thereof due the Lessor for that or any future year.

(c) *Royalty* – On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources hereinafter on a monthly basis, the Lessee shall pay to the Lessor:

(1) A royalty of percent on the amount or value of steam, or any other form of heat or energy derived from energy produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(2) A royalty of percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Sec. 1 of the Mineral Leasing Act of August 25, 1920, as amended, (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as specified in such statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of percent of the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or in reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than two ($2) dollars per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference before the expiration date of the lease year for which it is paid.

(d) *Waiver and Suspension of Rental and Royalties* – Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Undivided Fractional Interests* – Where the interest of the Lessee in the geothermal resources in the underlying any tract or tracts described in Sec. 1 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessee in the geothermal resources underlying such tract is to the full fee interest.

(f) *Readjustments* – Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. PAYMENTS – It is expressly understood that the Secretary may establish the value or minimum royalties of geothermal resources to compute royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. BONDS – The Lessee shall file with the Authorized Officer of the Bureau (hereinafter called the "Authorized Officer") shall maintain at all times the bonds required under the regulations to be furnished prior to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into different funds from those into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At the Lessee's election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require so that the leased lands may be properly and timely developed and for the production of geothermal steam and its by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a permit therefor is not obtained with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessor, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of his option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water required by law or by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Sec. 25 to enforce that requirement.

Sec. 7. INSPECTION – The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. CONDUCT OF OPERATIONS – The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3264, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of this lease, including the stipulations attached hereto, will be subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION

(a) The Lessee shall be liable to the Lessor for any damage suffered by the Lessor in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS – The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN – Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. REPORTS AND OTHER INFORMATION – At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect on the environment by operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. DILIGENT EXPLORATION – In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the primary term the Lessee shall make at least

the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS – The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to improvements or monuments owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, as far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return the roads or trails and the leased land to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE – The Lessee shall use all reasonable precautions to prevent waste of natural resources or energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or mineral deposits zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, air, and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS – The Lessee shall gauge or otherwise measure all geothermal steam and utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. Reports on production, disposition, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

Sec. 17. RESERVATIONS TO LESSOR – All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal* – The right to sell or otherwise dispose of the surface of the leased lands or any portion thereof, or leasbd lands under existing laws, or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) *Rights-of-way* – The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights* – The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Wells* – The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations; and

(e) *Measurements* – The right to measure geothermal resources and to sample geothermal steam.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE – The Lessee shall immediately bring to the attention of the Supervisor or Secretary any cultural resources, archaeological resources, fossils, or other objects of historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Secretary or Supervisor with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 433-433). Prior to operations, the Lessee shall contact the Authorized Officer a certified statement that either no archaeological values exist or that they do exist and to the extent known to the best of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values exist or if either the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of all operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the Lessor or the Surface owner.

Sec. 19. DIRECTIONAL DRILLING – A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the nearby land for the purposes of this lease, and production of geothermal resources from the leased area through any directionally well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any right in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES – The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the Lessor have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS – The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE OR UNIT PLAN – The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development shall have been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE – The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation to make payment of all accrued rentals and royalties and to plug all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall have a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools, and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed in the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other lands.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee, as provided above, which are allowed to remain on the leased lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at its own expense, or if it fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations, and that default shall continue for a period of thirty (30) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Sec. 5 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occuring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST – Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST – No Member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. MONOPOLY AND FAIR PRICES – The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all rules necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE – The Lessee agrees that, during the performance of this contract:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (29) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however*, that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 30. CERTIFICATION OF NONSEGREGATED FACILITIES – By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, or restaurants or other eating areas, time clocks, locker rooms, and other storage or dressing rooms, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise. Lessee further agrees that (except where it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 18 ANTIQUITIES AND OBJECTS OF HISTORIC VALUE

Prior to any operations under this lease, the Lessee will engage a qualified archeologist, acceptable to the Authorized Officer, to make an archeological survey of the land to be disturbed or occupied. A certified statement, signed by the qualified archeologist, setting out the steps taken in the survey and the findings thereof as to the existence of antiquities or other objects of historic or scientific interest, shall be submitted to the Authorized Officer. If the statement indicates the existence of such objects which might be disturbed by operations under this lease, the Lessee shall take such steps as may be required by the Authorized Officer, including archeological salvage. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvage property shall remain the property of the Lessor or the surface owner.

The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific value of interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433).

In witness whereof the parties have executed this lease.

Lessee:

THE UNITED STATES OF AMERICA, Lessor:

(Signature of Lessee)

By _____
(Authorized Officer)

(Signature of Lessee)

(Title)

SEAL

(Date)

(Date)

GPO 855-471

Appendix VII

Description of Soils in the Area

Frohman, Nyssa & Malheur Series

INITIAL REVIEW DRAFT

Tentative Series
Rev. BBL-AON
8/20/71

FROHMAN SERIES

The Frohman series is a member of the coarse-silty, mixed, mesic family of Xerollic Durorthids. Typically, Frohman soils have light brownish gray silt loam A and B horizons over a duripan at 12 inches.

Typifying Pedon: Frohman silt loam - cultivated
(Colors are for dry soil unless otherwise noted.)

Ap 0-8"--Light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium platy parting to weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine pores; mildly alkaline (pH 7.6); abrupt smooth boundary. (7 to 10 inches thick)

B2 8-12"--Light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many fine and very fine pores; moderately alkaline (pH 8.2); abrupt smooth boundary. (7 to 10 inches thick)

Clsim 12-18"--Pale brown (10YR 6/3) indurated duripan of silt loam material, dark brown (10YR 3/3) moist; massive; extremely hard, extremely firm; thin light gray (10YR 6/1) laminar capping on surface of duripan; root mat on surface; many very fine pores; moderately alkaline (pH 8.2). (3 to 10 inches thick)

C2 18-28"--Light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; hard, friable, nonsticky, nonplastic; few very fine pores; moderately alkaline (pH 8.4); clear wavy boundary. (0 to 14 inches thick)

C3ca 28-36"--Light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; massive; hard, friable, nonsticky, nonplastic; few very fine pores; strongly calcareous; moderately alkaline (pH 8.4); abrupt smooth boundary. (0 to 8 inches thick)

C4casim 36-42"--Very gravelly indurated duripan; massive; extremely hard, extremely firm; pebbles coated with lime.

2 - Frohman Series

Type Location: Malheur County, Oregon. 30 feet north of the county road and 60 feet west of the center line of section 27, SE¼, SW¼, T. 18 S., R. 44 E.

Range in Characteristics: The mean annual soil temperature ranges from 52° to 56° F. The soils are usually dry but moist for more than 60 days during the winter season. Depth to the duripan ranges from 10 to 30 inches but most commonly is 10 to 20 inches. Depth to very gravelly horizons ranges from 20 to 40 inches and bedrock is deeper than 40 inches. The A and B horizons are mildly or moderately alkaline and commonly noncalcareous but some pedons are weakly calcareous in the B horizon. The texture of the A and B horizons above the duripan is silt loam or very fine sandy loam with less than 18 percent clay and less than 15 percent fine sand and coarser. The A horizon has values of 6 dry and 3 or 4 moist and chromas of 2 or 3 dry and moist. The B horizon has values of 6 dry and 3 or 4 moist and a chroma of 3 moist and dry. It has weak prismatic or subangular blocky structure. In some pedons the weak B horizon is replaced with a C horizon and is massive. The upper duripan is silty and is indurated in the upper part and the remaining part ranges from weakly to strongly cemented. In some pedons the silty, friable C and Cca horizons are lacking. The underlying very gravelly duripan is indurated or strongly cemented in the upper few inches becoming less cemented with depth.

Competing Series and their Differentiae: These are the Burke, Chiara, Minidoka, Nyssa, and Stanfield series. All of these soils lack the very gravelly duripan and horizons within 40 inches. Burke soils are

calcareous below 6 inches. Minidoka soils have strong Cca (calcic) horizons at depths of 7 to 15 inches. Stanfield soils have high exchangeable sodium, are somewhat poorly drained, and very strongly alkaline in some part above the duripan.

Setting: Frohman soils are on nearly level to gently sloping terraces with gradients up to 20 percent but commonly less than 8 percent at elevations of 2,100 to 3,000 feet. The soils are formed in lacustrine material and very gravelly alluvium. The climate is semiarid with a mean annual precipitation of 9 to 11 inches and hot dry summers and cold winters. The mean annual temperature is about 50° to 54° F.; mean summer temperature is 70° to 74° F.; and the mean winter temperature is 31° to 33° F. The frost-free period ranges from 130 to 170 days.

Principal Associated Soils: These are the competing Nyssa soils and the Owyhee and Virtue soils. The Owyhee soils lack duripans. The Virtue soils have argillic horizons.

Drainage and Permeability: Well drained; slow to moderate runoff; moderate permeability to the duripan.

Use and Vegetation: Soils are in range and are cultivated with irrigation. Irrigated small grains, alfalfa, pasture and occasional row crops are the principal crops. Vegetation consists of Sandberg bluegrass, bluebunch wheatgrass, big sagebrush, and annual forbs.

Distribution and Extent: Southeastern Oregon. The series is inextensive.

Series Proposed: Malheur County, Oregon, 1959.

Remarks: The Frohman series was formerly classified as Sierozem soils.

National Cooperative Soil Survey
U. S. A.

Tentative Series
Rev. BBL-AON
7/9/71

NYSSA SERIES

The Nyssa series is a member of the coarse-silty, mixed, mesic family of Xerollic Durorthids. Typically, Nyssa soils have light brownish gray and pale brown silt loam A and B horizons over a duripan at 20 inches.

Typifying Pedon: Nyssa silt loam - cultivated
(Colors are for dry soil unless otherwise noted.)

Ap 0-13"--Light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; few roots; many very fine tubular pores; mildly alkaline (pH 7.5); clear smooth boundary. (5 to 13 inches thick)

B2 13-20"--Pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few roots; many very fine tubular pores; neutral (pH 7.0); clear wavy boundary. (7 to 10 inches thick)

C1casim 20-25"--Light gray (10YR 7/2) silt loam, grayish brown and brown (10YR 5/2 and 5/3) moist; massive, extremely hard, extremely firm, slightly sticky, slightly plastic; very few roots; common very fine tubular pores; 40 to 50 percent cemented calcareous durinodes 1/4 to 1 inch by 1/4 to 1/2 inches; strongly calcareous; moderately alkaline (pH 8.1); abrupt wavy boundary. (3 to 8 inches thick)

C2casim 25-31"--Light gray (10YR 7/2) indurated duripan of silty material, brown (10YR 5/3) moist; weak very thick platy structure; thin silica indurated lenses on top of plates with a matting of roots and reddish brown organic matter on top of silica lenses; extremely hard, extremely firm, nonsticky, nonplastic; no roots except for mats on lenses; many very fine and fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); clear wavy boundary. (2 to 6 inches thick)

C3casim 31-52"--Similar to horizon above except being massive.

2 - Nyssa Series

Type Location: Malheur County, Oregon. 80 feet southeast of 4 foot vertical stand pipe turnout in NW¼, SW¼, SW¼ section 11, T. 20 S., R. 46 E.

Range in Characteristics: The mean annual soil temperature ranges from 52° to 56° F. The soils are usually dry but most for more than 60 days during the winter season. Depth to the duripan ranges from 15 to 40 inches but is dominantly 20 to 30 inches. Depth to bedrock or very gravelly material is greater than 40 inches. The A and B horizons above the duripan are mildly to moderately alkaline and commonly noncalcareous but some pedons are weakly calcareous in the B horizon. The texture of the A and B horizon above the duripan is silt loam or very fine sandy loam with less than 18 percent clay and less than 15 percent fine sand and coarser. The A horizon has values of 6 dry and 3 or 4 moist and chromas of 2 or 3 moist and dry. The B horizon has values of 6 dry and 3 or 4 moist and chromas of 3 moist and dry. It has weak prismatic or subangular blocky structure. In some pedons the B horizon is replaced with a C horizon and is massive. The duripan is indurated in some part and the remaining part ranges from weakly to strongly cemented. It is massive or platy.

Competing Series and their Differentiae: These are the Burke, Chiara, Frohman, Minidoka, and Stanfield series. Burke soils are calcareous below 6 inches and lack the durinodes above the duripan. Chiara soils have duripans at depth of 12 to 15 inches. Frohman soils have very gravelly loamy indurated and friable horizons at depths of less than 40 inches. Minidoka soils have strong Cca (calcic) horizons at depths of 7 to 15 inches. Stanfield soils have high exchangeable

sodium, are somewhat poorly drained, and very strongly alkaline in some part above the duripan.

Setting: Nyssa soils are on nearly level to gently sloping terraces with gradients up to 20 percent but commonly less than 8 percent at elevations of 2,100 to 2,600 feet. The soils are formed in lacustrine materials with the surface reworked by wind. The climate is semiarid with a mean annual precipitation of 9 to 11 inches and hot dry summers and cold winters. The mean annual temperature is 50° to 54° F.; the mean summer temperature is 70° to 74° F.; and the mean winter temperature is 31° to 33° F. The frost-free period ranges from 150 to 170 days.

Principal Associated Soils: These are the Greenleaf, Owyhee and Virtue soils. The Greenleaf soils have an argillic horizon and lack duripans. The Owyhee soils lack duripans. The Virtue soils have argillic horizons.

Drainage and Permeability: Well drained; slow to moderate runoff; moderate permeability to the duripan.

Use and Vegetation: Principal use is irrigated crops: sugar beets, potatoes, onions, small grain, specialty seed crops, mint, and alfalfa. Vegetation consists of big sagebrush, Atriplex spp., bud sagebrush, needlegrass, Sandberg bluegrass, annual fescue, and associated forbs.

Distribution and Extent: Southeastern Oregon and southwestern Idaho. The series is inextensive.

4 - Nyssa Series

Series Proposed: Malheur County, Oregon, 1946.

Remarks: Nyssa soils were formerly classified as Sierozem soils. Areas of this soil under cultivation have been altered through management. All fields have been planed. Many have been leveled with major cuts and fills exposing calcareous soils on the surface while burying other horizons deeper.

National Cooperative Soil Survey
U. S. A.

INITIAL REVIEW DRAFT

Tentative Series
BBL-AON
2/9/72

MALHEUR SERIES

The Malheur series is a member of the fine-silty, mixed family of Xerollic Naduragids. Typically, Malheur soils have light brownish gray silt loam A1 horizons, light gray silt loam A2 horizons, yellowish brown silty clay loam B2 horizons, and pale brown calcareous silt loam C horizons over indurated hardpans.

Typifying Pedon: Malheur silt loam - range
(Colors are for dry soils unless otherwise stated.)

A1 0-5"--Light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy structure; soft, friable, slightly sticky, slightly plastic; many roots; many very fine pores; moderately alkaline (pH 8.0); abrupt smooth boundary. (3 to 6 inches thick)

A2 5-9"--Light gray (10YR 7/2) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; soft friable, slightly sticky, slightly plastic; many roots; many very fine tubular pores; moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 5 inches thick)

IIB2t 9-17"--Yellowish brown (10YR 5/4) silty clay loam, dark brown (10YR 3/3, 4/3 crushed) moist; strong fine columnar parting to moderate blocky structure; very hard, firm, very sticky, very plastic; common fine roots; few very fine tubular pores; continuous moderate clay films on ped faces and in pores; moderately alkaline (pH 8.2); clear wavy boundary. (6 to 10 inches thick)

IIB3t 17-23"--Pale brown (10YR 6/3) heavy silt loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky, plastic; common fine roots; many very fine tubular pores; few moderately thick and thin clay films on peds and in pores; moderately alkaline (pH 8.4); clear wavy boundary. (2 to 6 inches thick)

2 - Malheur Series

IIC1ca 23-31"--Pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist;massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; many very fine tubular pores; common ¼ to ½ inch soft lime coated concretions; slightly calcareous; moderately alkaline (pH 8.4); abrupt smooth boundary. (4 to 8 inches thick)

IIIC2sicam 31-35"--White (10YR 8/2) indurated duripan; very pale brown (10YR 7/4) moist; platy; continuous silica laminar capping; strongly calcareous.

Type Location: Malheur County, Oregon. 400 feet west of fence corner and 100 feet south of east and west road along the fence in NE¼, SW¼, SE¼, section 11, T. 16 S., R. 47 E.

Range in Characteristics: The mean annual soil temperature ranges from 49° to 53° F. These soils are dry in the moisture control section for more than half the time (cumulative) that the soil temperature at 20 inches is above 41°F. and dry for more than 90 consecutive days within the 3 month period following the summer solstice between 4 and 12 inches, but moist more than 60 days during the winter months. The solum ranges from slightly to strongly alkaline. Depth to duripan ranges from 20 to 40 inches. It is underlain by stratified, medium textured lakelaid sediments. The A horizon has values of 6 or 7 dry and 3 or 4 moist and chromas of 2 or 3 moist and dry. The B2t horizon has values of 5 or 6 dry and 3 or 4 moist and chromas of 3 or 4 moist and dry.It is silty clay loam with 27 to 35 percent clay and less than 15 percent coarser than very fine sand. Some pedons have strong or moderate prismatic or strong fine blocky structure. Exchangeable sodium in the B2t horizon exceeds 15%. The B3t horizon is silty clay loam or heavy silt loam. It has moderate prismatic, subangular or blocky structure. Depth to calcareous material ranges from 18 to 26 inches.

3 - Malheur Series

Competing Series and their Differentiae: These are Cortez, Ocho, Sebree, and Tempahute series. The Cortez, Ocho, and Tempahute soils have more than 35 percent clay in the natric horizon. Sebree soils have a high accumulation of salts in the lower part of the natric horizon and depth to calcareous material ranges from 7 to 20 inches.

Setting: Malheur soils are on nearly level, undulating or somewhat disected medium or high terraces at elevations ranging from 2,400 to 2,800 feet. They have formed in mixed lakelaid sediments with a surface influence of loess. The climate is semi-arid with a mean annual precipitation of 9 to 11 inches; mean annual temperature is about 50° to 54° F.; the mean summer temperature is 70° to 74° F.; and the mean winter temperature is 31° to 33° F. The frost free period ranges from 140 to 160 days.

Principal Associated Soils: These are the Nyssa, Owyhee and Virtue soils. The Nyssa and Owyhee soils lack argillic horizons. The Virtue soils have less than 15% exchangeable sodium in the argillic horizon.

Drainage and Permeability: Well drained; slow to medium runoff; moderately slow permeability in the B horizon.

Use and Vegetation: Range and under cultivation with small grains, hay and pasture the principal crops. Vegetation consists of Thurber's needlegrass, Sandberg bluegrass, 6 weeks fescue, bluebunch wheatgrass, and big sagebrush.

Distribution: Northeastern Malheur County, Oregon. The series is of small extent.

Series Proposed: Malheur County, Oregon, 1972.

4 - Malheur Series

Remarks: These soils would have been placed in the Solonetz soils. The Malheur series was a tentative series and was dropped in 1966 and correlated to Virtue. Since then it has been established that there is sufficient acreage for the series and information confirming the natric horizon. The series is on the Oregon Agricultural Experiment Station in Malheur County.

National Cooperative Soil Survey
U. S. A.

Appendix VIII

Comprehensive Land Use Plan
for
Malheur County, 1973

This comprehensive land use plan, prepared by the Malheur County Planning Commission, is not included in this reproeuction of the Vale Geothermal E.A.R. A copy of this 44 page plan may be viewed at:

1. *The BLM District Office at Vale, Oregon.*
2. *The BLM State Office at Portland, Oregon.*
3. *The County Records of Malheur County at Vale, Oregon.*

Appendix IX

Malheur County Zoning Ordinance

This zoning ordinance is not included in this reproduction of the Vale Geothermal E.A.R. A copy of this 56 page ordinance may be viewed at:

1. *The BLM District Office at Vale, Oregon.*
2. *The BLM State Office at Portland, Oregon.*
3. *The County Records of Malheur County at Vale, Oregon filed as Microfilm Instrument No. 148901 (filed 8-17-1973).*

Appendix X

Geothermal Ordinance for Malheur County

This geothermal ordinance is not included in this reproduction of the Vale Geothermal E.A.R. A copy of this 26 page ordinance may be viewed at:

1. *The BLM District Office at Vale, Oregon.*
2. *The BLM State Office at Portland, Oregon.*
3. *The County Records of Malheur County at Vale, Oregon filed as Microfilm Instrument No. 158761 (filed 6-20-1974).*

APPENDIX XI

Archeological Assessment of the Vale KGRA Supplement

A Report Submitted to the Oregon
Bureau of Land Management

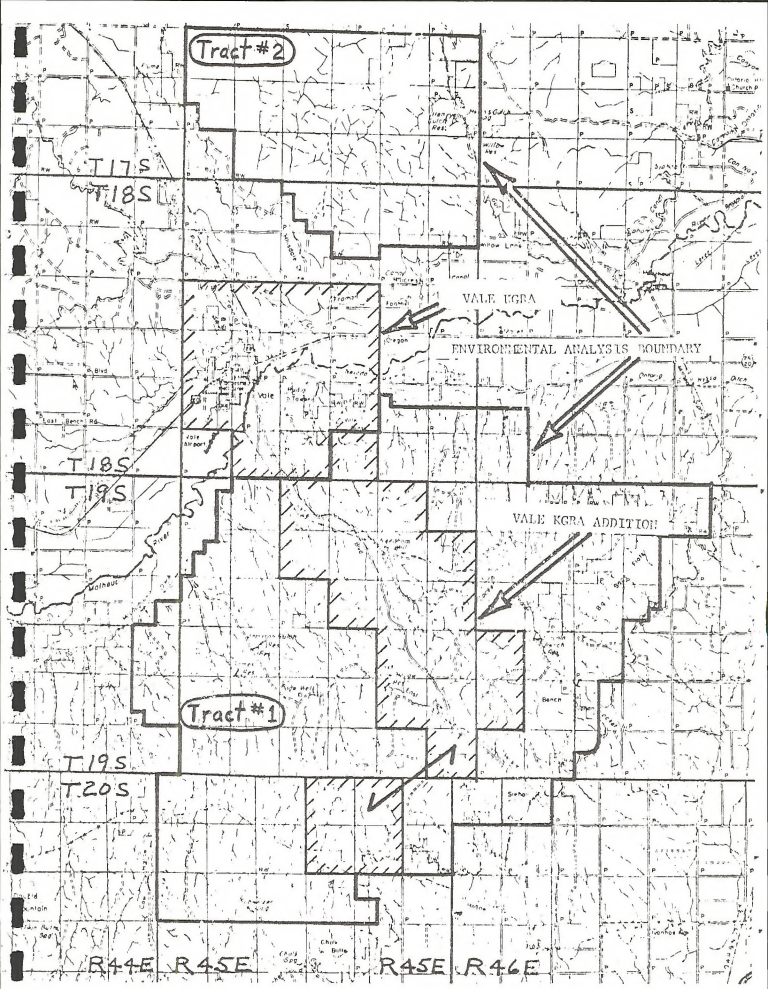
by

George N. Ruebelmann
April, 1975

Preface

Antiquities are like single-copy books that are out of print: once destroyed, they can never be replaced. The data of the past have been, are, and will continue to be our most important source for understanding the earth, its resources, and man. The protection and conservation of this source of data should therfore be of prime concern to all people who believe their descendants are entitled to understand and appreciate the world of the past.

This report is organized in such a fashion as to provide the minimum protection needed for the antiquities discovered prior, during, and subsequent to the present study. This is achieved by the use of detachable appendices which contain the information pertaining to the nature and location of the specific antiquities sites. The appendices should not be freely distributed to the public or any other persons who do not have a need to know. The body of the report should also be given some limited distribution. The disclosure of this information will undoubtedly result in the destruction and looting of the sites by those persons with pack-rat attitudes toward antiquities.


Tract #2
T17S
T18S
VALE KGRA
ENVIRONMENTAL ANALYSIS BOUNDARY
T18S
T19S
VALE KGRA ADDITION
Tract #1
T19S
T20S
R44E
R45E
R45E
R46E

Introduction

This antiquities study is intended to provide cultural resource data for an Environmental Analysis Record (EAR) of the Vale Known Geothermal Resource Area (KGRA) Supplement. The study was undertaken with the understanding that the result would be only an estimation of the quantity and quality of the antiquities which exist within the National Resource Lands outlined in Figure 1. "Antiquities," as used in this report, refer to those objects, features, and sites which have or may have historical, archeological, or paleontological significance. Although the contract stipulated that only historical and archeological interests need be considered, paleontological materials were recorded where and when they were encountered during the field examination.

A change in the final boundaries of the Vale KGRA Supplement added about 29,000 acres to the original 36,000 acres outlined in the map accompanying the contract. Since it greatly increased the total area for which time and expenses had been computed, the change was discussed with Dr. Grayson of the Oregon State Office of the Bureau of Land Management. It was subsequently decided that the antiquities survey should cover only as much area as possible within the limits of the original estimate submitted prior to the issuance of the con-

tract. Fortunately, the excellent accessibility of the southern portion of the KGRA Supplement permitted a rapid and quite thorough field examination and thus, averted the exclusion of an extensive area in the assessment.

Objectives

According to the stipulations in the contract, the objectives of the antiquities survey were as follows:

1. Assess the potential quantity and quality of antiquities within the Vale KGRA Supplement boundaries.
2. Evaluate the possible impact of geothermal energy development upon the potential antiquities.
3. Recommend measures or procedures which would mitigate possible adverse impact.

Methods

The following methods or procedures were employed in order to accomplish the above objectives:

1. Examination of records which have a bearing on antiquities within the Vale KGRA Supplement and surrounding area. These records consisted of the University of Oregon Museum of Natural History archeological survey files, the Vale BLM District cultural resource records, and pertinent technical literature which has been published in various sources.

2. Interviews of local residents who have knowledge of the area's antiquities. Knowledgeable persons included relic collectors and professionals attached to educational institutions.
3. Observations of antiquities in the field. This method involved traversing the area by motor vehicle and on foot. Notes and records were kept on all discoveries and observations which might have any possible significance.

Description of the Study Area

The National Resource Lands within the Vale KGRA Supplement boundaries include two large tracts of land adjacent to the Lower Malheur River of Eastern Oregon. Tract #1 is comprised of approximately 51,000 acres and is situated to the south of the Malheur Valley. Tract #2 consists of approximately 14,000 acres and lies north of the Malheur Valley (see Figure 1). Both tracts are upland areas and are drained by ephemeral streams contained in arroyos.

The study area lies within the northern part of the Malheur-Owyhee Upland Section of the Columbia Intermontane Physiographic Province (Allison 1968). Stratigraphic relations of the geologic formations are described as "a complex sequence of lenticular intercalated basalt; rhyolite; rhyolitic ash-flow tuff; autoclastic, fluviatile, lacustrine, and air-fall volcaniclastic deposits; and diatomite" (Kittleman and

others 1965:2). Locally, the Tertiary Age conglomerates and sandstones of the Deer Butte Formation are exposed on the surface where aeolian, lacustrine, and alluvial deposits of the Pleistocene have been removed. Topographically, the area is characterized by rolling hills, sand dunes, steep buttes, and deep arroyos. Erosion appears to be the dominant geomorphic process currently active in the region.

The climate of the region is characterized by hot, dry summers and cold, moist winters. Precipitation is less than 10 inches annually and occurs mainly in winter (Rudd 1968).

The vegetation reflects both the arid climate and overgrazing by livestock. Sagebrush dominates the landscape although grasses are the more numerous plants. Trees (cottonwoods) occur near springs and seeps which are few in the study area.

A variety of small and large animals inhabit the study area (see pp. 16-22a in Vale KGRA EAR). Deer, antelope, coyotes, and numerous rodents, birds, lizards, and insects were observed during the field examination.

The Antiquities Assessment

Examination of Records

The antiquities study commenced with the attempt to examine various records which may have contained information on those antiquities previously recorded or observed in the

Vale area. Following standard procedure, a letter (see Appendix A) requesting information of this type was sent to the University of Oregon Museum of Natural History (U.O.M.N.H.) where the Oregon Archeological Survey and Oregon State Paleontological Site Survey files are housed. A reply letter (Appendix A) stated that only one archeological, and one paleontological sites were recorded for the area. Of these, only the paleontological site (UO2266) was actually within the Supplement boundaries. This site is situated in Tract #1 and was relocated independently during the field examination. The archeological site had been recorded as a "cave", the location of which was near the Malheur River south of Tract #2. However, the accompanying legal coordinates are exactly the same as the "open" site which was preliminarily excavated in 1972-73 by Treasure Valley Community College of Ontario, Oregon (Long 1974). Specific details and locations of these sites are described in the copy of the letter from Mr. D. Cole dated April 2, 1975 which is included in Appendix A .

While the above correspondence was in progress, the Vale BLM District Office records were inspected for similar information. These records included a letter from Dr. Shotwell of the U.O.M.N.H. who identified some Pliocene fish bones which had been submitted by a Mr. Don Peterson. The specimens were said to be common around the Willow Creek area, part of which, is included within Tract #2 of the Supplement.

Another letter in the files (from D. Cole to Vale Dis-

trict Manager dated 10-21-71) discussed the nature of certain prehistoric stone artifacts which had been submitted to the U.O.M.N.H. by Vale District BLM personnel. None of this information concerned the area within or near the KGRA Supplement.

The Environmental Analysis Record for the original Vale KGRA contained information on "three possible archeological or historical sites" said to be located near Vale Butte (BLM Staff 1974:Section 30). These sites, a rockshelter with a stone wall built across its mouth, and two rectangular stone structures, had evidently been discovered by BLM personnel. It was reported that two of the three sites had been vandalized after their locations were disclosed in the Cultural Values appendix of the E.A.R. Although they are not within the Supplement boundaries, the sites should be given special attention since they lay within the original KGRA boundary. Two of the three sites are situated on patented lands, the other on National Resource Lands. Their cultural affiliation is historic American, and prior use by aborigines seems likely for the rock-shelter.

Following the records check, various technical and/or professional publications pertaining to the history and archeology of Eastern Oregon were examined. Since the Oregon Trail crossed the KGRA Supplement (Tract #1), the National Register of Historic Places was inspected on the chance that there might be sites which were qualified to be entered therein. No sites were listed which actually were located within the Supplement.

The National Park Service publication, Historic Sites

Along the Oregon Trail (A. L. Haines 1973), was also examined. It provided details about the wagon ruts which parallel Lytle Boulevard for ½ mile near the drainage divide in Section 14, Township 19 South, Range 45 East. The ruts can be easily seen along the west side of the highway at this location.

Two historic sites of note are located within the original Vale KGRA: Stonehouse in the city of Vale, and the John D. Henderson grave just ½ mile south of Vale. These sites are associated with the Oregon Trail and the later Boise-to-Canyon City stage road.

The literature on the archeology of the Vale region is as scanty as the number of archeological studies conducted there. The only source of archeological data for the Lower Malheur Valley is a monograph titled The Moore Ranch Dig. This report describes the results of the 1972 T.V.C.C. excavations of a campsite located near the Malheur River (Long 1974). The site ought to have special significance to regional archeologists as it represents the only site to my knowledge to contain a single component belonging exclusively to the "Elko" complex of the Northern Great Basin. The site is located just outside the southern boundary of Tract #2 and thus provides minimum comparative information for the area within the Supplement.

No other archeological literature exists for this part of Eastern Oregon specifically, but there are several reports on studies in adjacent areas. David H. Chance's Survey of

Antiquities Management on Bureau of Land Management Lands in Oregon 1968 is an excellent statement on the status of antiquities in Oregon as a whole. On the basis of size, Chance declared the Vale BLM District as the principal area for antiquities resources, and also, for problems relating to their destruction. Although Chance did not examine the Lower Malheur region specifically, his recommendations for the future management of antiquities in other areas are equally applicable. Other reports are represented by John Fagan's (1973), Stephen Bedwell's (1970) and Margaret Weide's (1968) doctoral dissertations. Fagan examined selected spring sites in the Malheur Lake region south of Burns, while Weide studied the settlement pattern in the Warner Lakes region. Stephen Bedwell's dissertation summarizes the archeology of the Fort Rock Valley (1970). These sources were consulted for comparative archeological data and general background for examining the archeology of the Vale region.

Paleontological literature was also examined, but I lacked both the expertise to understand the sources completely and the ability to identify the fossils recovered in the field. Two sources in particular were read for background: Miocene Mammals of Southeast Oregon (Shotwell 1968) and Pliocene Mammals of Southeast Oregon and Adjacent Idaho (Shotwell 1970).

Interviews

Two persons from the nearby community of Ontario were interviewed about the potential antiquities value of the Vale KGRA Supplement. Mr. Jeff Ford, Associate Dean of Community Education at Treasure Valley Community College, kindly provided the information on the Moore Ranch Site. He also suggested two areas within Tract #2 of the study area where antiquities might be found. He reported that he had discovered what he thought were camel bones located in a sand dune approximately in the center of Tract #2. Mr. Ford also stated that a projectile point belonging to the Plains Paleo-Indian complex (Eden) was found somewhere along Henry's Gulch in Tract #2. These statements could not be coroborated when the areas were checked in the field, but this is probably due to not knowing the exact locations of the finds. It is likely that the paleontological site is genuine, however.

Mr. Ford arranged for me to meet and talk with Mr. Horace Arment, a noted amateur natural historian in Eastern Oregon. Mr. Arment has an extensive collection of historical, archeological, and paleontological materials which mainly derive from the southeastern part of the state. He informed me that he knew of no antiquities, other than those disclosed by Mr. Ford, that came from the KGRA Supplement. He said the area was noted for its paucity of archeological remains, a statement which seemed to be accurate with respect to the field observations.

Field Observations

The field examination of the Vale KGRA Supplement was hampered by adverse weather conditions and snow-covered ground. The starting date of the survey was delayed until March which fortunately began with two weeks of warm, clear days. These conditions changed abruptly to periods of rain and snow which continued intermittantly throughout the rest of the month. The larger of the two tracts, Tract # 1, was examined during the fair-weather period and thus received greater attention (relatively) than Tract # 2.

The initial strategy of the survey was to inspect at least one area within each section of land for the presence of historical and archeological remains. For the most part, this strategy was successful. The criteria for choosing the sample areas were derived from a framework of anthropological theory which stresses the mundane conditions of human existence. These criteria are believed to be the same as, or analogous to, the criteria which humans employ to select their own habitation / exploitation sites. The criteria are summarized as follows:

1. The proximity of the site to subsistence resources which include water, food, and fuel.
2. The proximity of the site to suitable technological materials (stone, metal, wood, fiber, etc.).
3. The shelter and climate afforded by the site location.

Following these criteria, the areas examined within any geographical region would normally include the land along streams, lakes, springs, and other sources of water; rock outcrops or cliff faces which might

contain rockshelters and caves; the deposits of suitable technological materials (stone, mainly); areas containing an abundance or clustering of edible plants and animals; areas with suitable agricultural land; and other resource areas. The criteria are subject to modification or exclusion because of the particular characteristies of any given geographical region. Modified or excluded criteria are usually considered during the course of field observations, however.

The KGRA Supplement was traversed on foot and by motor vehicle. During the field examination, a total of eleven archeological and three paleontological sites were discovered which had no t been previously recorded. A fourth paleontological site was rediscovered before it was known from the records check. One of the paleontological sites contains paleobotanical speciments which may be identifiable. The sites and their locations are described in Appendix B.

Significance of the Archeological Sites

The lack of water is the most important factor in interpreting the significance of the archeological sites. The most striking characteristic of the KGRA Supplement is its aridity: the low precipitation and the highly permeable geologic formations make the drainages and seeps acutely ephemeral. No water, except that from man-developed sources, was observed in Tract #1 during the field period. Tract # 2 was only slightly different, having one free-flowing spring on its eastern boundary.

The majority of the archeological sites most likely represent satellite hunting camps and/or weapons preparation areas related to hunting activites. The upland areas are presently plentiful in game and, if conditions were similar in the past, could have been regularly hunted

by the prehistoric inhabitants of the Malheur Valley. The locations of the sites in the arid uplands suggests they are not major habitation sites since these would require a source of water within a relatively short distance. However, a temporary hunting excursion from the Malheur Valley into these nearby uplands would not require much water at all. And, there is always the possibility that the upland areas produced more water in the past than at present.

Quarrying appears to have been a minor activity and probably is associated with hunting excursions. The quarry sites do not, in general, exhibit a great quantity of lithic waste material which may indicate that better quality stone was obtainable elsewhere. This belief is supported by the fact that the Moore Ranch Site in the Malheur Valley yielded mostly obsidian artifacts and chipping waste. The coarse gravel deposits, where all of the quarry sites in the KGRA Supplement are situated, do not contain many obsidian nodules, yet, most of the chipping detritus is of obsidian.

All of the discovered archeological sites appear to be low-intensity human occupation areas. That is, they are not likely, by themselves, to be of considerable importance in the understanding of the prehistory of Eastern Oregon. However, this does not mean that the sites should be ignored and left unprotected from both mechanical-and human-related destruction. When examined in conjunction with high-intensity sites of adjacent areas, they may be critical sources of information on the economic and social patterns of the prehistoric inhabitants of the region.

To generalize, the archeological potential of the Vale KGRA Supplement is low in terms of quality and quantity. The eleven recorded low-intensity archeological sties are believed to be representative of this potential, and it is entirely possible that they may comprise as much as 75 percent or more of the Supplement's total cultural resources.

Significance of the Paleontological Sites

The paleontological sites discovered during the survey may contain important fossils, but this should be determined by one who has expertise in paleontology.

Impact on Antiquities by Geothermal Energy Exploitation

In considering the effects of geothermal energy development upon the antiquities in the Vale KGRA Supplement, the main factors are the number and the location of the sites. The only important historical site is the area where the Oregon Trail ruts occur. This particular site is protected by the National Trails System Act (1968) and is, I understand, to be excluded from geothermal development altogether. The archeological and paleontological sites, therefore, will be the focus of the impact discussion.

Geothermal energy exploitation has two phases of operation which may affect the status of nearby antiquities. These are the exploration phase and the power plant and power line installation phase. Both affect antiquities by disturbing the surface of the land.

Exploration Impact

Destruction or damage of antiquities can result from the following which are associated with the geothermal energy exploration phase:

1. Drilling
2. Land Clearance
3. Construction of access roads

Of the three operations, drilling is the least harmful to antiquities because the actual location of the drill site is flexible. Damage can be avoided because the exploration shaft can be drilled at an angle; this allows the drilling operations to be performed away from sites containing antiquities. Yet the drill can essentially explore the same sub-surface areas for geothermal energy. Land clearance and road construction will cause the greatest amount of disturbance to antiquities. Some care should be observed in planning these operations and mitigation of their impact may be necessary.

Powerplant and Powerline Impact

Two ground disturbing operations which are associated with the powerplant and powerline installation phase may affect the antiquities in the KGRA Supplement:

1. Land clearance
2. Construction of structures

Both operations are destructive to antiquities and the powerplant and powerline locations should be planned well in advance in order to avoid them. Since the locations of these installations is contingent, in part, upon the location of the geothermal vent, the drill shaft will initially have to be placed far enough away from the antiquities sites. Otherwise the damage to any antiquities will have to be mitigated.

Mitigation Recommendations

Future Study

If the antiquities potential of the KGRA Supplement were high, an inventory survey would be necessary to fully prepare and plan for the onslaught of geothermal energy development. However, an inventory of the area's antiquities is not recommended because it would not be fruitful; that is, an inventory would cost far more than what would be gained in scientific and asthetic values. An alternate method of on-the-spot clearance is more satisfactory in terms of time, money, and antiquities conservation. The method consists of a system whereby the Vale B.L.M. District or the Geothermal Lease Applicant employs a professional to inspect and monitor the areas where the actual exploration and development are to take place. It is preferable that the B.L.M. employs this person since that organization is ultimately responsible for all resources within the lands under its control. This would be in keeping with the spirit of the cultural resource management program which is presently emerging in the B.L.M. The cost of maintaining this system could be compensated by assessing a fee to the geothermal lease permit as is done to grazing permits.

Impact Mitigation

All archeological, and three of the four paleontological, sites are not situated in the Vale KGRA Addition along Lytle Boulevard, and it is only a remote possibility that they will be disturbed directly by geothermal development. However, a paleontologist should be consulted

about the future status of the fourth paleontological site which is located in the Addition. A quick check with authorities at the University of Oregon Museum of Natural History may be all that is necessary in this case.

If it is impossible to avoid the antiquities by planning and clearance investigations, certain sites will have to be salvaged by mapping and excavation techniques. Salvage would only be necessary for the non-quarry archeological sites in the KGRA Supplement, and the implementation of the techniques would require a small crew of trained personnel and sufficient time to allow it to remove the antiquities involved. The salvage operations may cost a considerable amount of money.

In the long run, avoidance of the sites is the more favorable solution than salvage to antiquities conservation. Academic and scientific institutions do not have the time or personnel to devote to the salvage of all antiquities which may eventually be threatened by economic expansion. Also, present-day scientific methods and techniques are not sophisticated enough to retrieve the maximum potential information from the data obtained by excavation. Avoidance of antiquities is more feasible for geothermal operations because of the availability of flexible drilling methods.

References

Allison, Ira A.

1968 Landforms. In Atlas of the Pacific Northwest, edited by Richard M. Highsmith, Jr., pp. 27-30. Corvallis: Oregon State University Press.

Bedwell, Stephen F.

1970 Prehistory and environment of the Pluvial Fort Rock Lake area of south central Oregon. Ann Arbor: University Microfilms Inc.

B.L.M. Staff

1974 43 C.F.R. Part 23: Technical Examination Report and Environmental Analysis Record for Vale Known Geothermal Resource Area. Manuscript on file at the Vale District Office, Oregon Bureau of Land Management.

Chance, David H.

1968 Survey of antiquities management on Bureau of Land Management lands in Oregon. Report submitted to Oregon Bureau of Land Management.

Fagan, John L.

1973 Altithermal occupation of spring sites in the northern Great Basin. Ann Arbor: University Microfilms Inc.

Haines. A. L., preparer

1973 Historic Sites Along the Oregon Trail. Historic Resource Study, U. S. National Park Service, Denver Service Center.

Kittleman, L.R. and others

1965 Cenozoic stratigraphy of the Owyhee Region, southeastern Oregon, Eugene: Pulletin of the Museum of Natural History, University of Oregon, No. 1.

Long, Edward T., editor

1974 The Moore Ranch Dig, Ontario: Treasure Valley Community College Press.

Rudd, R.D.

1968 Climate. In Atlas of the Pacific Northwest, edited by Richard M. Highsmith, Jr., pp. 31-37. Corvallis: Oregon State University Press.

Shotwell, J. Arnold

1968 Miocene mammals of southeast Oregon. Eugene: Bulletin of the Museum of Natural History, University of Oregon. No. 14.

1970 Pliocene mammals of southeast Oregon and adjacent Idaho. Eugene: Bulletin of the Museum of Natural History, University of Oregon, No. 18.

Weide, Margaret L.

1968 Cultural ecology of lakeside adaptation in the western Great Basin, Ann Arbor: University Microfilms Inc.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION
345 Middlefield Road
Menlo Park, California 94025

February 20, 1975

Memorandum

To: District Manager, Vale District Office

From: Acting Area Geothermal Supervisor

Subject: USGS Input for Vale KGRA Addition EAR

Enclosed for your use is a copy of our input for Vale KGRA Addition EAR preparation. If you have questions concerning the input, please contact Chuck Larson at (415) 323-8111, Ext. 2841.

Dwayne E. Hull

Encl.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION
OFFICE OF THE AREA GEOTHERMAL SUPERVISOR
MENLO PARK, CALIFORNIA

VALE, OREGON KGRA ADDITION

U. S. GEOLOGICAL SURVEY INPUT

For

ENVIRONMENTAL ANALYSIS RECORD

Prepared in Cooperation With

Area Geologist's Office, Menlo Park, California

February, 1975

A12-c

VALE, OREGON, KGRA ADDITION

U. S. GEOLOGICAL SURVEY INPUT

For

ENVIRONMENTAL ANALYSIS RECORD

INTRODUCTION

The non-living aspects of the environment, including the geology, of the original Vale, Oregon, KGRA, has been briefly described in an earlier EAR. The geology of the Vale KGRA Addition (original KGRA and addition defined on Figure 1) is fundamentally the same as the original KGRA. Additional studies, including a brief field examination and extensive literature research, have been completed by the USGS. These studies have brought to notice certain geological data which merit amplification beyond the description in the earlier EAR.

GEOLOGY AND GEOLOGICAL HAZARDS

PHYSIOGRAPHY

The Vale KGRA and Addition lie near the southwestern margin of the Columbia River Plateau Physiographic Province. The more prominent topographic forms in the region are largely the result of the general westward

tilt of the resistant lava flows which form cuesta-like escarpments. The nonresistant character of the softer sedimentary deposits associated with the lavas results in more subdued topography, characteristically exhibited within the Vale KGRA and Addition (Corcoran and others, 1962). Elevations within the KGRA and Addition range from about 2,250 ft. (m.s.l.) near the town of Vale, in the alluvial plain of the Malheur River, to about 3,000 ft. on the southern flank of Chalk Butte, near the southern extremity of the KGRA Addition. Local relief ranges from rugged on the slopes of Rinehardt Butte and Vale Butte, to moderately hilly in the plateau region comprising most of the KGRA and Addition.

GEOLOGIC SETTING

Stratigraphy and Lithology: Exploration for oil and gas in the Vale area has demonstrated that the stratigraphic section consists of partly consolidated sandstones, siltstones and fresh-water limestones with intercalated basalt flows at irregular intervals. The sedimentary rocks of the Idaho Group represented include the Miocene Deer Butte Formation and the Pliocene Kern Basin and Chalk Butte Formations. The intercalated basalt flows are assigned to the Grassy Mountain Basalt, also of Pliocene age. It is considered that portions of the sedimentary section, particularly the sandstones, should provide adequate porosity and permeability for a geothermal reservoir.

The thickness of the Idaho Group may range up to a maximum of 4,000 ft. or more in the area, although an unknown portion of this apparent thickness may represent repetition by faulting.

Dissected and eroded remnants of Pleistocene alluvial terrace gravels are abundant along the margins of the Idaho Group uplands adjacent to the alluvial plains of the Snake and Malheur Rivers. The Terrace deposits range up to 30 ft. thick, and are generally very coarse, containing cobbles up to 6 in. diameter in a pebbly to sandy matrix. Because of their poorly consolidated nature, the gravels tend to drape down the flanks of ridges.

Holocene (Recent) alluvial deposits are confined mainly to the major valley floors, which are the flood plains of the Snake and Malheur Rivers. The Holocene alluvium is generally fine-grained and consists of a large proportion of volcanic ash derived principally from the poorly consolidated sediments of the Idaho Group.

The areal distribution of the rock units and a diagrammatic representation of the stratigraphic column are shown on the geologic map of the Mitchell Butte Quadrangle, Oregon, scale 1:62,500 (Corcoran and others, 1962), from which Figure 2 has been adapted.

Structural Geology: The Vale KGRA and Addition are located on the western flank of the Snake River Downwarp, a large structural trough extending from Yellowstone Park, across southern Idaho and into eastern Oregon. Progressive development of the downwarp contemporaneously with the extrusion of lavas and fluvio-lacustrine deposition

of sediments account for the large thickness of the Tertiary volcanic and sedimentary section. The position of the Vale KGRA and Addition, marginal to the Snake River Downwarp, is reflected in the local dips of the Idaho Group beds, up to 5° to the ENE.

Oregon State geologists (unpublished data and personal communications) believe that a series of north-trending parallel faults of Early Pliocene age, mapped by Corcoran and others (1962), extended northward, across the Vale area, but are masked by younger, essentially unfaulted sediments of the Idaho Group. This zone of faulting could be as much as 8 to 10 miles wide and may be subsidiary to major faults bounding the Snake River Downwarp. The probability of concealed faults underlying the younger Idaho Group sediments is supported by unpublished magnetic and gravity surveys of the area (R. G. Bowen and R. E. Corcoran, personal communications, 1974).

LOCAL GEOLOGY

The sedimentary rocks of the Chalk Butte Formation lie at or near the surface throughout most of the Vale KGRA and Addition. Erosional remnants of ancient topographic highs developed upon the older Deer Butte Formation emerge through the Chalk Butte Formation at Vale Butte and Rinehardt Butte southeast of the town of Vale. The gentle northeasterly dips and probable north-trending faults common to the district prevail throughout the KGRA and Addition. Most of the KGRA and Addition lie at elevations above the Pleistocene terrace gravels.

GEOTHERMAL MANIFESTATIONS

Geothermal and geochemical data from the Vale Hot Springs are incomplete and unavailable for publication. Geothermal gradient studies conducted near and within the KGRA and Addition indicate a range of gradients from 94°C to 232°C per kilometer, with a mean gradient of 153°C/km, 7.6 times higher than the worldwide average. Heat flow measurements range from 3.6 ± 0.4 to 6.9 ± 0.4 heat flow units (HFU), with a mean of 5.4 HFU, 3.6 times the worldwide average (T. G. Bowen, 1972). Locations of shallow heat flow holes are shown on Figure 3.

GEOLOGIC HAZARDS

Slope Stability: No areas of slope instability have been specifically identified within the Vale KGRA or Addition. Portions of the Chalk Butte Formation are known to contain components of montmorillonite clay, a weathered or alteration product of volcanic ash. Strata with a significant montmorillonite content may be prone to slumping or mass wasting on exposed slopes and cuts, where subjected to repeated cycles of wetting and drying. Where montmorillonite is present in significant proportion, however, weathered slopes, road cuts, etc., commonly exhibit a "pilled" or "popcorn" texture on the surface. Such "popcorn" textures have not been observed within the KGRA and Addition, suggesting that the montmorillonite content of the near-surface sediments is low and that hazards related to slope stability are minimal. Nevertheless, cuts into the toes of slopes should be avoided.

Seismicity: Geothermal resources are, by their nature, located within regions of greater than average seismic activity and seismic risk. In most cases, including the Vale KGRA and Addition, this is reflected mainly in the increased frequency of microseismic and non-destructive seismic events. Geothermal development, including massive withdrawals of fluid, as well as reinjection of a portion of the fluid, could have an effect of either increasing or reducing seismic activity. The potential hazards which might result cannot be effectively evaluated until a program of seismic monitoring in the area has been established.

Subsidence: A potential for subsidence exists wherever fluids, geothermal or otherwise, are withdrawn from poorly consolidated aquifers charged at greater than hydrostatic pressures. Furthermore, geothermal reservoirs are often charged at pressures lower than hydrostatic. Formation evaluation and monitoring during geothermal development and production is necessary to evaluate the potential subsidence effects and to differentiate induced subsidence from naturally occuring tectonic activity.

GROUNDWATER RESOURCES AND HAZARDS

GROUNDWATER RESOURCES

Table I includes data obtained from all known wells in the KGRA. (E. Boone, 1974 unpublished communication). Well locations are plotted on Figure 4. The small number and limited yield of the wells indicate a meager potential for further development, at least for shallow wells

(depth of 700 ft.). More productive aquifers may occur at greater depths. Groundwater utilization in the KGRA and surrounding area is currently limited to stock watering.

GROUNDWATER HAZARDS

Drilling for geothermal exploration, development and production may introduce a potential hazard for groundwater contamination and depletion. Geothermal fluids may contain substances which would be deleterious if allowed to enter aquifers containing good quality water. Such potentially deleterious components could include high concentrations of Na, Ca, Mg, Cl, CO_2 and minor, but nevertheless harmful concentrations of B, As, NH_4, CH_4, H_2S and SO_2. As the known groundwater resources of the Vale KGRA and Addition appear meager, the potential hazards may be regarded as minimal.

MITIGATING MEASURES

The geologic and groundwater hazards previously discussed can be mitigated at least in part. These measures should be properly addressed in the preparation of the Plan of Operation (30 CFR 270.34) on a site specific basis.

Access routes, proposed drill sites and possible future plant sites should be examined in detail to ascertain that conditions of slope instability do not exist. The results of seismic monitoring should be taken into account in the structural design of any installations.

Induced seismicity can be prevented by careful selection and spacing of production and disposal wells. Circulation of geothermal fluid through reservoir formations or aquifers often produces an effect of geothermal alteration with the deposition of cementing minerals thus may consolidate the aquifer and diminish the potential risk of subsidence.

The geothermal Resources Operational (GRO) Orders, administered by the U.S. Geological Survey, Office of the Area Geothermal Supervisor, include comprehensive provisions for protection of the environment. Under the terms of the GRO Orders, geothermal operations may be suspended if it can be demonstrated that such operations are contributing to any of the hazards discussed. The Orders include stringent specifications controlling well development and placement of casing and cement to protect aquifers. The Orders also include provisions to assure that the minimum Federal, State and local standards and criteria set for soil, water, air and noise pollution be met.

REFERENCES

Baldwin, H. L., Jr., and Hill, D. P., 1960, Gravity survey in part of the Snake River Plain, Idaho - a preliminary report: U. S. Geol. Survey open-file report, 21 p.

Bowen, R. G., 1972, Geothermal gradient studies in Oregon: Ore Bin, vol. 34, no. 4, p 68-71.

Bowen, R. G., 1973, Geothermal activity in 1972: Ore Bin, vol. 35, no. 1, p. 4-7.

Bowen, R. G., and Peterson, N. V., 1970, Thermal springs and wells in Oregon: Oregon Dept. Geology and Mineral Industries Misc. Paper 14.

Corcoran, R. E., Doak, R. A., Porter, P. W., Pritchett, F. I., and Privrasky, N. C., 1962, Geology of the Mitchell Butte quadrangle, Oregon: Oregon Dept. Geology and Mineral Industries Geol. Map Ser. 2.

Kirkham, V. R. D., 1931, The Snake River downwarp: Jour. Geology, vol. 39, no. 5, p. 456-468.

Kruger, P. and Otte, C., eds., 1973, Geothermal energy, Stanford Press Stanford, Ca., 360 p.

Malde, H. E., 1959, Fault zone along northern boundary of northern Snake River plain: Science, vol. 130, no. 3370, p. 272.

Russell, I. C., 1903a, Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon: U. S. Geol. Survey Water Supply Paper 78, 51 p.

Russell, I. C., 1903b, Notes on the geology of southwestern Idaho and southeastern Oregon: U. S. Geol. Survey Bull. 217, 83 p.

Waring, G. A., 1965, Thermal springs of the United States and other countries of the world - a summary: U. S. Geol. Survey Prof. Paper 492, p. 38-41.

Washburne, C. W., 1909, Gas and oil prospects near Vale, Oregon, and Payette, Idaho: U. S. Geol. Survey Bull. 431, pt. 11, Mineral Fuels, p. 35-49.

White, D. E., 1965, Geothermal energy: U. S. Geol. Survey Circular 519, p. 14.

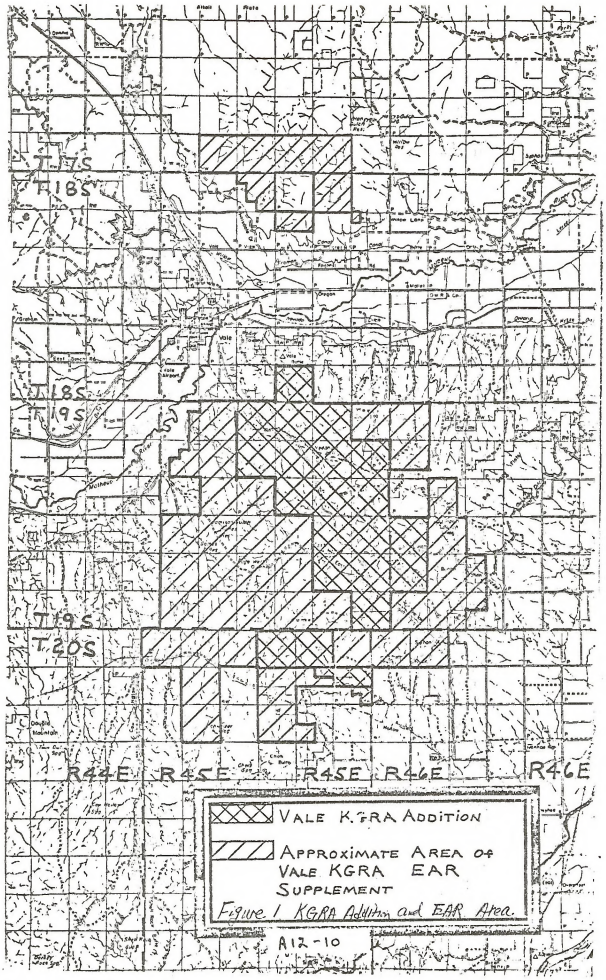


Figure 1. KGRA Addition and EAR Area.

Geologic Map of the MITCHELL BUTTE QUADRANGLE

Oregon

VALE HOT SPRINGS ..... Black Lines KGRA
KGRA + ADDITIONS 9/27, 12/18 ..... Red Line EAR Area

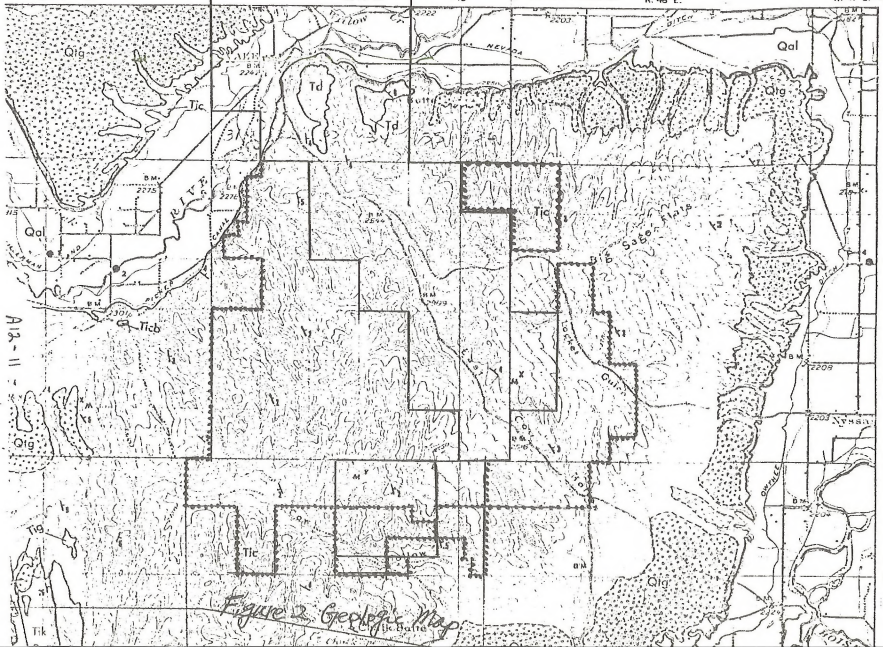


Figure 2. Geologic Map

E X P L A N A T I O N

Symbol	Age	Formation
Qal	Quaternary (Holocene)	Recent alluvium
Qtg	Quaternary (Pleistocene)	Terrace gravels
Tic	Tertiary (Pliocene)	Chalk Butte Formation
Td	Tertiary (Miocene)	Deer Butte Formation

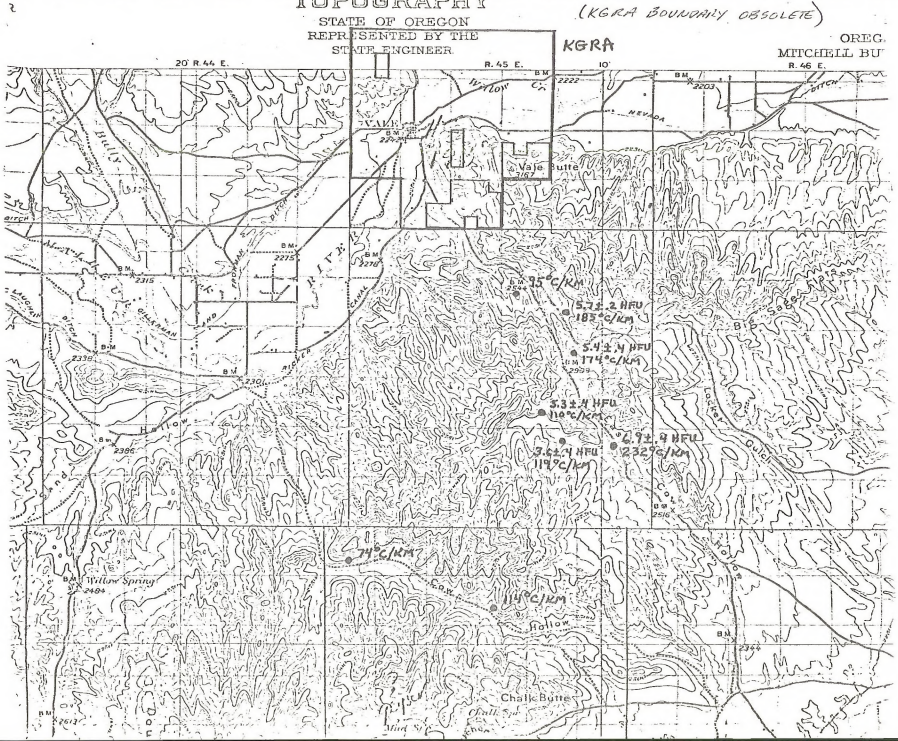


Figure 3 Geothermal Observation Well (KGRA Boundary obsolete) A12-13

TABLE I

Water Well Data, Vale KGRA and Addition

NAME	LOCATION	T.D.	STATIC WATER LEVEL	YIELD	TEMP.
1. No name	1950' from E. line 2600' from S. line Sec. 18, T.19S., R. 46E.	Unknown	Abandoned & apparently dry.	———	———
2. Needham Well	500' from W. line 2200' from N. Line Sec. 11, T. 19S., R. 45E.	494'	385' (measured)	un-known	Reportedly hot
3. N. Harper Well	2100' from E. line 2400' from S. line Sec. 9, T. 19S., R. 45E.	696'	569' (Drillers Log) 685' Well Maint. man	8/9 gal. min.	65°F. Init. 92°F. Max. 50° Air temperature
4. Page Well	2500' from E. line 1300' from N. line Sec. 28, T. 19S., R. 45E.	622'	435'	12 gal. minute	52° F. Init. 80° F. Max. 40° F. air
5. No Name	1500' from W. line 2500' from N. Line Sec. 5, T. 20S, Range 45E.	Unknown	unknown	unknown	Probably 60°F., see explanation below.
6. No name	600' from E. line 1850' from S. line Sec. 26, T. 19S., R. 44 E.	unknown	abandoned apparently dry	unknown	unknown

E. Boone, Geologist, Bureau of Land Management, Vale, Oreg.

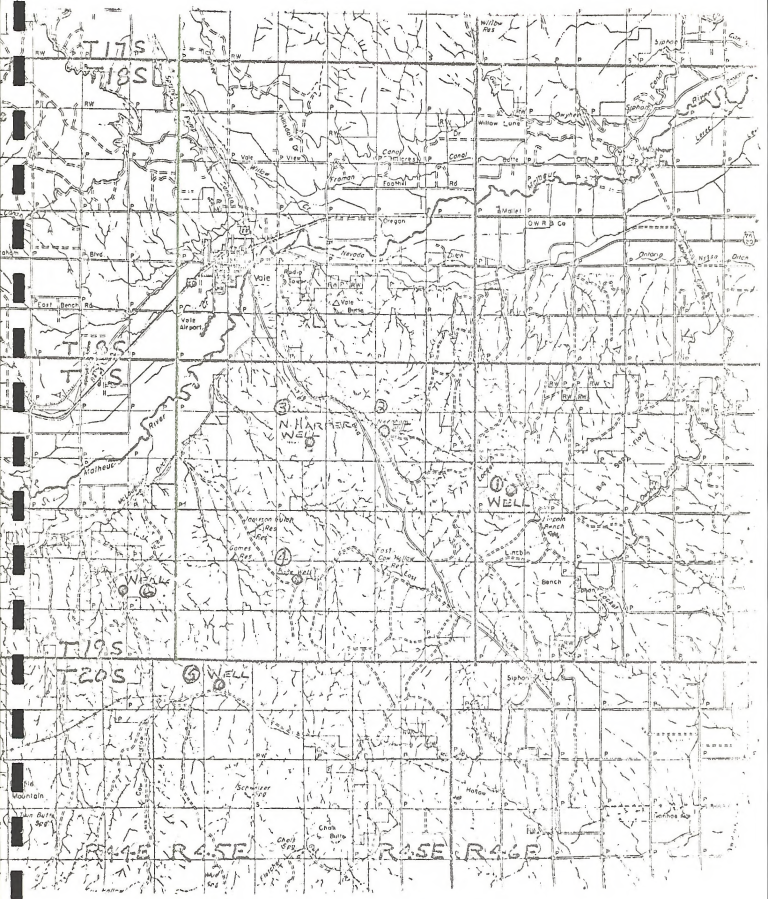


Figure 4. Water Well Locations

A12-15

LIST OF PARTICIPANTS

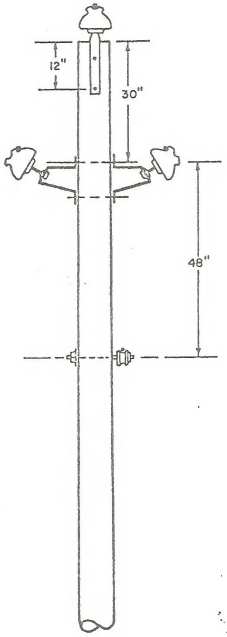
Area Geothermal Supervisor's Office	Area Geologist's Office
Chuck E. Larson	William H. Lee

APPENDIX XIII

Power Transmission Line Specifications

for

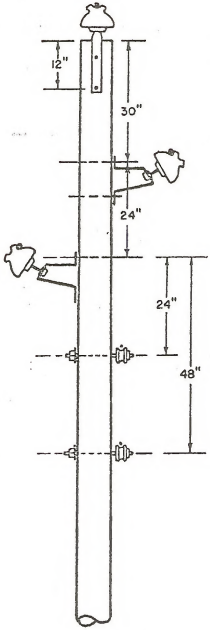
Protection of Birds of Prey



Armless Distribution
Triangular Construction

Approved type structure
to be installed in a
"Birds of Prey" area

Morlan W Nelson
Birds-of-Prey Consultant

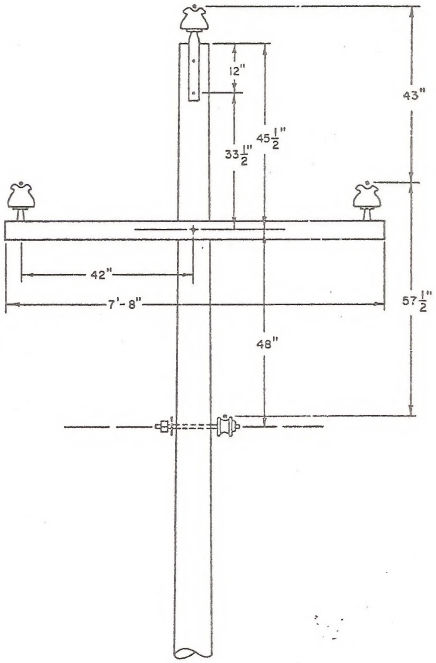


Armless Distribution
Staggered Construction

Approved type structure
to be installed in a
"Birds of Prey" area

Birds-of-Prey Consultant

A13-2



Crossarm Distribution
Triangular Construction

Approved for corrections
on preferred poles in
existing lines

Morlan W Nelson
Birds-of-Prey Consultant

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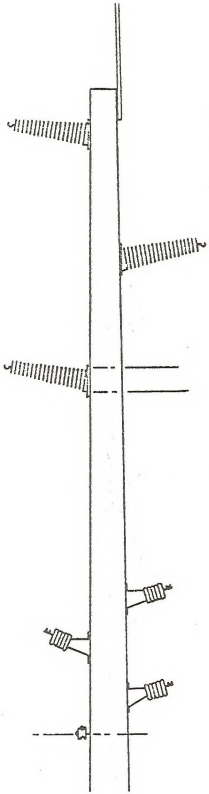

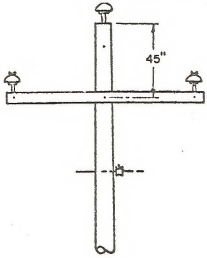

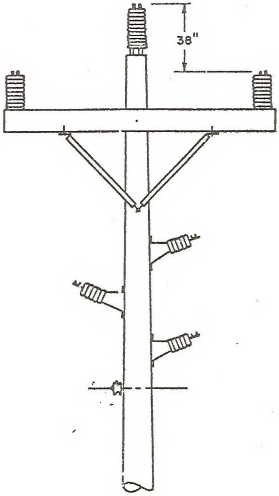

Approved type structure
to be installed in a
"Birds of Prey" area

Marian W. Nelson
Birds-of-Prey Consultant

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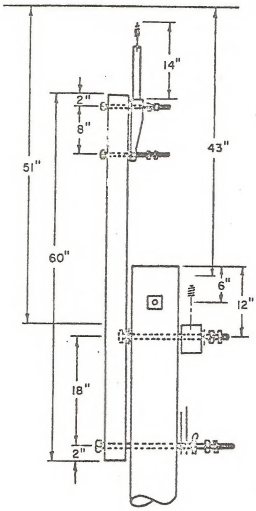
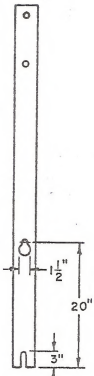
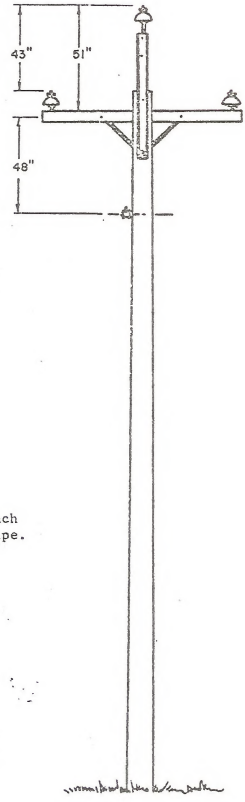


Assembly Detail



Fabricate from 3-inch galvanized steel pipe.



Center Phase Riser

Approved for corrections on preferred poles in existing lines

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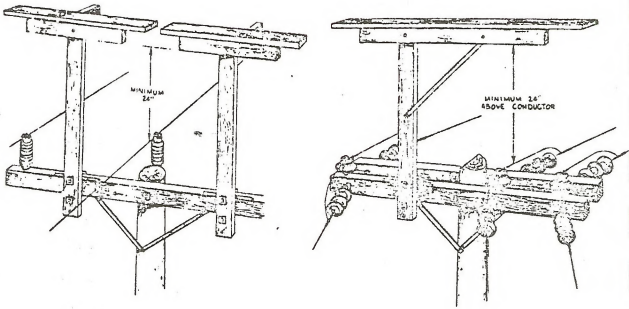
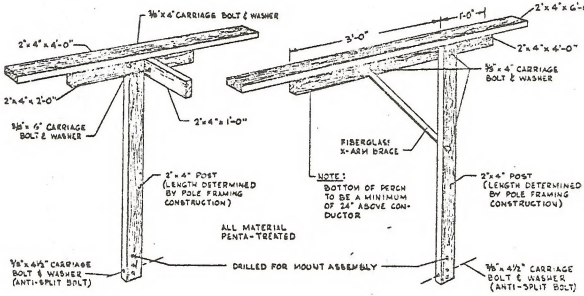
"T" Perch

Straight Perch



Typical Perch Applications



Perch Assembly Details

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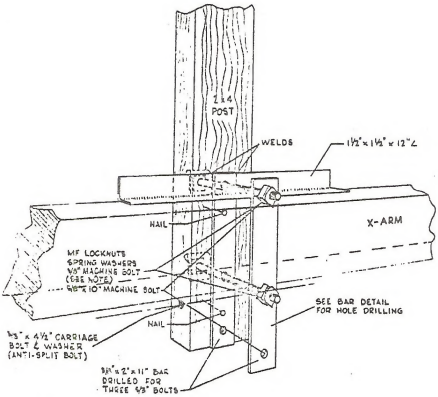
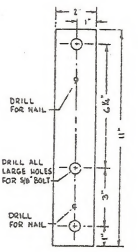
Morlan W. Nelson A13-6

Birds-of-Prey Consultant





MOUNT BAR DETAIL

MOUNT ASSEMBLY FOR
TYPES ① & ② PERCHES
(SHOWN MOUNTED ON LIGHT-DUTY X-ARM)

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on preferred poles in
existing lines

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Birds-of-Prey Consultant

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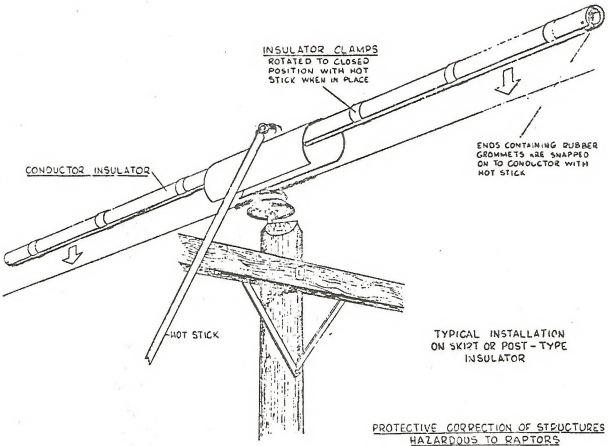

TYPICAL INSTALLATION ON SKIRT OR POST-TYPE INSULATOR

PROTECTIVE CORRECTION OF STRUCTURES HAZARDOUS TO RAPTORS
CONDUCTOR INSULATOR
IDAHO POWER COMPANY
SEPTEMBER 1972

Approved for corrections on preferred poles in existing lines

Morlan W. Nelson
Birds-of-Prey Consultant

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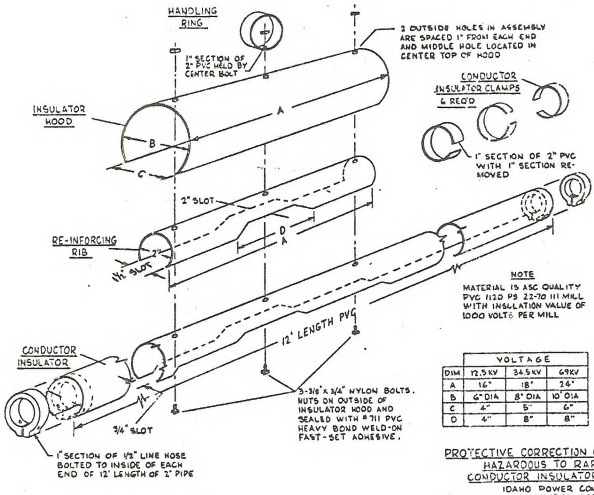

DIM	VOLTAGE		
	12.5 KV	34.5 KV	69 KV
A	16"	18"	24"
B	6" DIA	8" DIA	10" DIA
C	4"	5"	6"
D	4"	8"	8"

PROTECTIVE CORRECTION OF STRUCTURES HAZARDOUS TO RAPTORS
CONDUCTOR INSULATOR DETAILS
IDAHO POWER COMPANY
SEPTEMBER 1972

Approved for corrections on preferred poles in existing lines

Morlan W. Nelson
Birds-of-Prey Consultant

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